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NASCOM NETWORK
GROUND COMMUNICATIONS RELIABILITY REPORT

FOR
MARCH 1964

GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

NASCOM NETWORK
GROUND COMMUNICATIONS RELIABILITY REPORT

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Prepared by

NETWORK REVIEW AND ANALYSIS BRANCH
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PREFATORY NOTES

Data Sources

The data or information used in preparing this report has been obtained from:

- Trouble Tickets (GSFC Form 22-35),
- Analyses of Circuit Operations (GSFC Form 22-10),
- NASA Circuit Logs (GSFC Form 22-8T)
- Daily Communication Reports (DCR)

The Trouble Tickets and Daily Communication Reports provide most of the data or information used. To provide a "common denominator" for recording and interpreting trouble data, various trouble codes have been devised, as indicated below. These codes are used by the Facilities Control Group in writing the Trouble Tickets. The Tickets are classified on the basis of these codes, permitting interruption patterns to be determined quantitatively without needless rehandling of the Tickets.

Whenever a discrepancy or an ambiguity appears in the Trouble Tickets or in any of the other data sources listed above, Network Review and Analysis Branch personnel then contact the site or station involved to clarify, correct, or reconcile the data.

Trouble Category Code Designations

Symbol

A - NO TROUBLE FOUND: Cause unknown; trouble cleared before a definite cause and/or location could be determined.

B - LINE–CABLE–MICROWAVE: Failure of cable, microwave, or other similar connecting facilities between stations.

C - OPERATOR ERROR: Fault due to the human element, such as operation of equipment out of proper sequence, or improper insertion or removal of patch cords.

D - EQUIPMENT ADJUSTMENT: Fault caused by maladjustment of equipment.

E - EQUIPMENT FAILURE: Failure of any electrical or mechanical element.

F - WIRING DEFECT: Fault caused by any wiring defect.

G - POOR PROPAGATION: Radio path failure due to fading, low signal strength, or high atmospheric noise level.

I - INTERFERENCE: Any loss of signal intelligence due to interference of another radio signal.

K - FREQUENCY CHANGE: Loss of contact due to change of frequency.

M - MAINTENANCE: Lost time due to unscheduled maintenance (scheduled maintenance not being considered as an outage for analysis purposes).

P - POWER FAILURE: Failure of station stemming from loss of input or primary power.

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ILLUSTRATIONS (Continued)

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TABLES (Continued)

Table 1

GSFC Teletype Circuits to Outlying Stations—Group 1 Stations

TELETYPE CIRCUITS		STATION DESIG.	LOCATION
7005-01	*	ACRO	Carnarvon, Australia
7005-01	*	AWOM	Woomera, Australia
7005-01	*	AADE	Adelaide, Australia
7005-02	*	PCTN	Canton Island
7005-02	*	PHON	Honolulu, Hawaii
7005-02	*	PHAW	Kauai, Hawaii
7005-04	*	GCAL	Pt. Arguello, Calif.
7005-05	*	GGYM	Guaymas, Mexico
7005-06	*	GWHS	White Sands, N. Mex.
7005-07	*	GTEX	Corpus Christi, Tex.
7005-08	*	GEGL	Eglin, Fla.
7005-11	*	GMCC	Cape Kennedy, Fla.
7005-12	O/Wire	GMCC	Mission Control Center, Cape Kennedy, Fla.
7005-13	T/Only	GMCC	
7005-14	T/Only	GMCC	
7005-15	*	GMCC	
7005-18	T/Only	GMCC	
7005-19	T/Only	GMCC	
7005-22	R/Only	GMCC	
7005-23	R/Only	GMCC	
7005-17	*	LCYI	Grand Canary Island
7005-17	*	LKNO	Kano, Nigeria
7005-21	Part-time ckt	LKNO	Kano, Nigeria
7005-30	*	GBDA	Bermuda
7005-31	*	GBDA	Bermuda
GT-13179	*	GHOU	Houston, Tex.

NOTE: 1) Listing of circuits here does not mean all were utilized during the reporting period.

2) AADE-02, ACRO-02, AMUC-02, and AWOM-02 now comprise an alternate route circuit if and when needed.

*Full-time circuit.

Table 2

GSFC Teletype Circuits to Outlying Stations—Group 2 Stations

TELETYPE CIRCUITS	STATION DESIG.	LOCATION
NS-104	GALA	Huntsville, Ala.
NS-105	GFLD	St. Johns, Newfoundland
NS-108*	GQUI	Quito, Ecuador
NS-109*	GAGO	Santiago, Chile
NS-111*	GAPU	Lima, Peru
NS-117	GBPT	Blossom Point, Md.
NS-118	GYRS	Fort Myers, Fla.
NS-121	GACQ GWLP	Wallops Island, Va.
NS-126	GBEN	Owings Mills, Maryland
NS-131	GCON	Nutley, N. J.
NS-132	GNUT	Nutley, N. J.
NS-134	GTOC	Fort Monmouth, N. J.
NS-135	GTLH	Lakehurst, N. J.
NS-136	GROS	Rosman, N. C.
NS-138	GCON	Nutley, N. J.
NS-300	GSWB	Suitland, Md.
NS-300	GOLA	San Nicholas Is./PMR, Pt. Mugu, Cal.
NS-301/NS-729	GULA GINS	Gilmore Creek, Alaska College, Alaska
NS-302	GURO JGLD	PMR, Pt. Mugu, Cal. JPL, Pasadena, Cal.
NS-303	JMOJ	Mojave, Cal.
NS-700	GSAO	Cambridge, Mass.
NS-701(RA-30)*	GBUR	Johannesburg, South Africa
NS-702(RA-35)*	AOMJ	Woomera, Australia
NS-717	JJPL	JPL, Pasadena, Cal.
NS-721(RA-54)*	LJOB	Johannesburg, South Africa
NS-722	AOOM	Woomera, Australia
NS-723	LWNK	Berkshire, England
NS-731	GMUR GMAN	Murray Hill, N. J. Andover, Maine
NS-732	LBOD LTEL LHIL LGEA	Pluemuer-Bodou, France Fucino, Italy Goonhilly, England Raisting Point, Germany
NS-733	JRGO	Point Arguello, Cal.
NS-738	GTOC	Fort Monmouth, N. J.
NS-749	GULA	Gilmore Creek, Alaska
GT-13179	HMSC	Houston, Texas
74GT-265	GUNV	Adelphi, Md.
7905-17	LMAJ	Majunga, Rep./Malagasy
Joburg Backup*	GBUR	Johannesburg, South Africa

*Analysis of this station is included in this report.

NOTE: Listing of circuits here does not mean all were utilized during the reporting period.

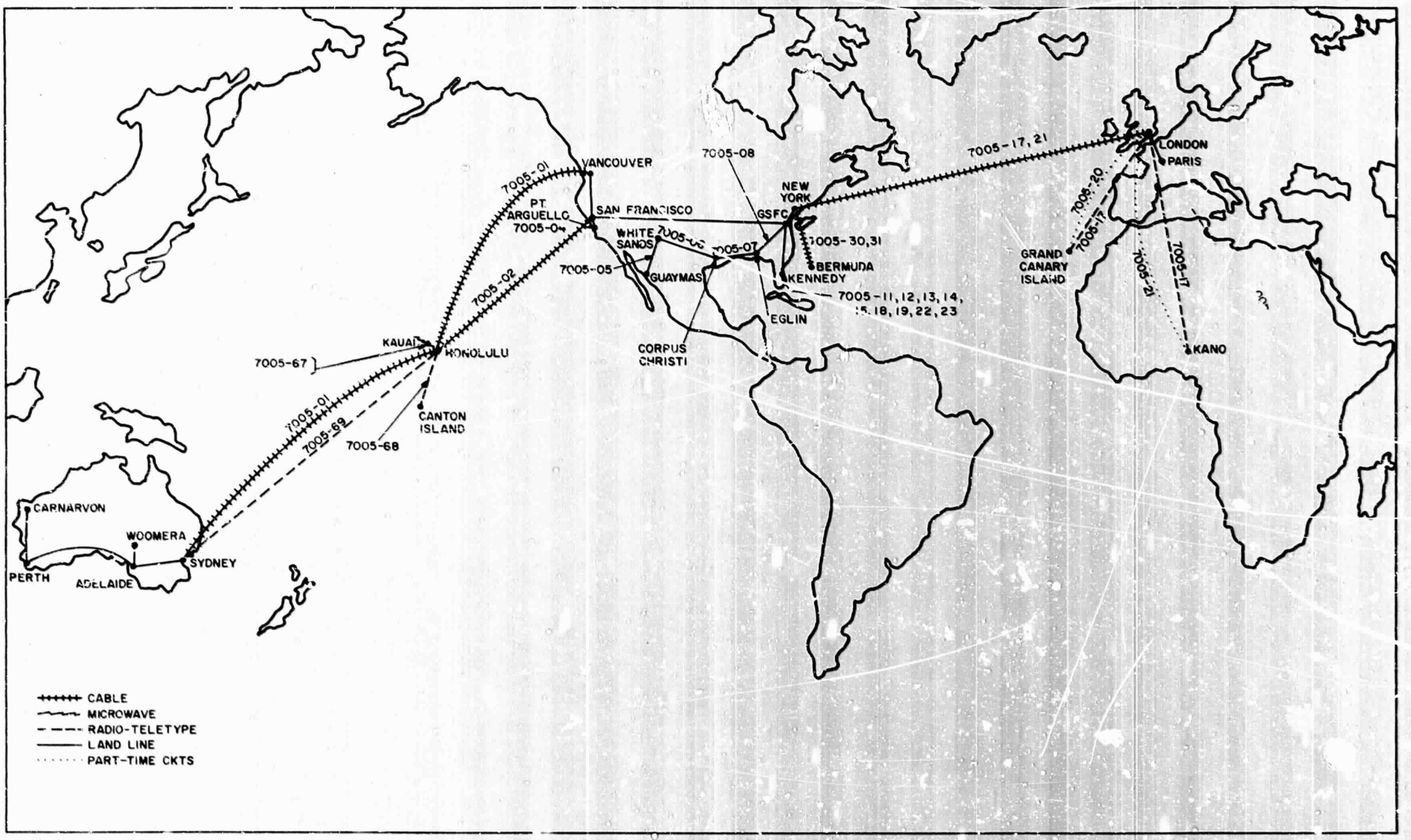


Figure 1. Map of NASCOM Network Teletype Circuits Group 1 Stations

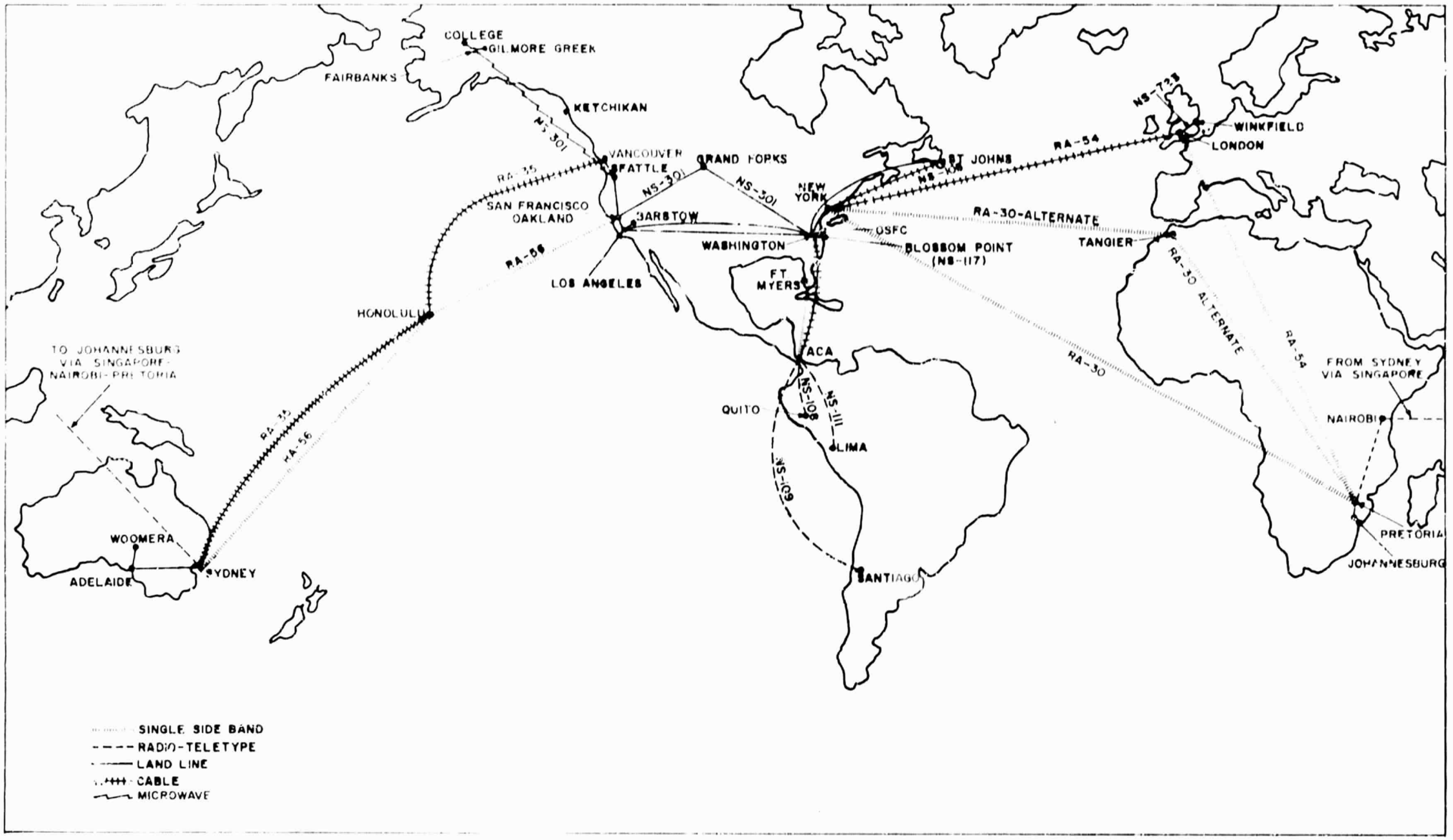


Figure 2. Map of NASCOM Network Teletype Circuits
Group 2 Stations

NASCOM NETWORK
GROUND COMMUNICATIONS RELIABILITY REPORT

INTRODUCTION

General

This report presents the significant results of an analysis of the performance and the attained reliability of the NASCOM Network for the month of March 1964. Teletype, voice, and high-speed data circuits connecting Goddard Space Flight Center (GSFC) with the stations listed in Tables 1 and 2 are evaluated herein with respect to their attained reliabilities.

For convenience in making the analysis and developing the resulting report, the several teletype circuits comprising the Network have been placed in Group 1 and Group 2. Their locations are shown geographically in the two maps, Figures 1 and 2 respectively. In general, only those teletype circuits exhibiting a moderate to severe degree of fluctuating reliability are dealt with in detail in the analysis. All teletype stations or circuits which have shown a consistently high degree of reliability are not analyzed, even though they are listed in either Table 1 or Table 2. Further, only those circuits directly supporting a particular mission(s) are normally included in this monthly report. Among current exceptions are the Houston voice circuits and the circuits to the Adelaide Comm-Center. The Adelaide facility is on an operational basis 24 hours-per-day and supports both Group 1 and Group 2 NASCOM Network activities. The Daily Communication Reports (DCR's) from Adelaide provide extremely useful data on (1) the Honolulu-Sydney radio path, (2) the San Francisco-Sydney radio path, (3) the Johannesburg-Sydney radio path, and (4) the Vancouver-Sydney cable. Consequently, evaluation of the performance of these several circuits is enhanced because of the additional information that is made available by the Adelaide facility.

Past experience in making the analyses of the various stations or circuits utilizing an HF radio link--or links—has shown that these have been the most troublesome from the standpoint of attaining a high reliability index. For this reason, the several troublesome HF radio circuits are analyzed in greater detail, including graphical analyses in some cases, in order to more effectively pinpoint the area(s) where corrective action is most urgently needed to upgrade the reliability characteristics of the network. The circuits selected for graphical analysis are those whose reliabilities changed significantly over the past 12-month period. In some cases, circuits other than the HF radio links are dealt with individually in some detail where this was deemed warranted.

If other segments of the NASCOM Network—whether HF radio, cable, or land-line—begin showing any degradation in performance and reliability, these too will be dealt with in greater detail in future reports to forestall any degradation of the overall Network.

Analysis of the NASCOM Network's SCAMA (Station Conferencing and Monitoring Arrangement) and high-speed data circuits will be found in the two following sections of this report.

Definitions of Terms

Operational reliability, as used in this report, is defined as the ratio of realized or actual circuit or network operating time to the total scheduled operating time, with this ratio then being expressed in percent.

The average long-term reliability (of either a station or a circuit) considered over a period of several months is determined by adding all outage time in a selected number of months and subtracting this figure from the total scheduled operating time of the circuit or station. The difference is then divided by the total scheduled operating time; the result, expressed in percent, is the degree of reliability.

In this report the terms "transmit" and "receive" are used in the text and also in the several tables and graphical presentations. These terms are used to designate the direction of the transmitted message—"transmit" denotes transmissions from Goddard Space Flight Center and "receive" denotes reception at Goddard Space Flight Center from the outlying station or sites. This nomenclature will be used throughout the report.

HF PROPAGATION CONSIDERATIONS

Conditions During March

Solar activity, which had been at a low level during the first two weeks of March, began to increase about the middle of the month. On March 16 at 1554Z an active region about 5 days west of Central Meridian Passage produced an importance 2 flare accompanied by a major radio noise burst. A sudden short wave fade-out occurred in the western (sunlit) hemisphere which lasted for about 50 minutes. A magnetic storm, with accompanying ionospheric disturbance, which was expected to follow as a result of the solor flare some 24 to 36 hours later, failed to occur. A new sunspot region was created on March 21, which gave birth to flares of importance 1 on its first day of activity, after which flare activity declined to a few sub-flares from time to time.

A magnetic storm occurred from March 3 through March 6. This storm followed by 27 days a period of increased magnetic activity.

Outlook for May

The magnetic storm which occurred from March 3 through March 6 had the characteristics of a recurrent storm and is therefore likely to repeat at 27-day intervals. Recurrence of this disturbance may be expected during the following periods:

March 31 to April 4
April 27 to May 1
May 24 to May 28

The magnetic disturbances which have been recurring on the 5th to the 10th days of the solar period have decreased markedly in intensity, and have in fact been below storm intensity for the last three solar rotations. If this storm revives, it will manifest itself during one or more of the following periods:

April 16 to April 20
May 13 to May 17

NETWORK TELETYPE PERFORMANCE ANALYSIS

Summary-Group 1 Stations

The composite reliability (of the transmit and receive paths combined) of the Group 1 stations in March was 99.4 percent. This figure represents an increase of 0.1 percentage point over the February total and 0.2 percentage point over the 12-month average of 99.2 percent, as indicated in Figure 3.

A comparison of the monthly reliabilities of nine Group 1 stations for the six-month period ending in March is given in Table 3, below. The average 6-month reliability index for each of the stations analyzed is tabulated in the right-hand column. Although two stations, Muchea and Zanzibar, have been de-activated during the last six months, reliability indexes for that portion of the period during which they were active are included in the table for reference purposes. The other operating stations or circuits listed in the chart, together with other Group 1 stations or circuits which experienced a decline in reliability or loss of operating time due to unusual causes in March, are discussed in more detail later.

Table 3

Teletype Circuit Reliability (Percent) for Nine Group 1 Stations

LOCATION	CIRCUIT DESIG.	OCT 1963	NOV 1963	DEC 1963	JAN 1964	FEB 1964	MAR 1964	SIX-MONTH AVERAGE
Adelaide	AADE-01	97.8	99.5	99.8	99.2	99.0	98.3	98.9
Bermuda	GBDA-30 GBDA-31	99.9	99.5	99.7	99.9	99.9	99.5	99.7
Canton Island	PCTN-02	97.8	99.4	99.4	99.1	99.4	98.1	98.8
Grand Canary Island	LCYI-17	99.5	96.0	99.1	98.3	99.1	99.4	98.5
Guaymas	GGYM-05	99.6	99.3	99.5	98.7	99.7	99.9	99.4
Kano	LKAN-17	98.7	96.0	91.5	97.1	100.0	99.1	97.0
Kauai Island	PHAW-01	99.1	99.5	99.9	99.2	99.9	98.8	99.4
Muchea	AMUC-01	96.6	98.8	98.4	98.7	97.1	-	*97.9
Zanzibar	LZZB-17	97.7	96.1	90.5	-	-	-	**94.7

**Zanzibar (LZZB-17) was dropped from the Network early in January 1964. Thus, a 3-month average is shown instead of a 6-month average.

*Muchea (AMUC-01) was dropped from the Network in February 1964. Accordingly, a 5-month average is shown instead of a 6-month average.

During March the Group 1 stations had a combined total scheduled operating time of 13,830 hours. The total time lost during the month from all causes amounted to 85:58 hours or 8:37 hours less than the amount of time lost in February. This decline in lost time occurred despite the fact that scheduled operating time for the month was 353 hours greater than that for February.

Outages caused by line-cable-microwave failures increased for the fourth consecutive month during the reporting period. Totalling 45.8 hours, these outages represented more than 50 percent of the total outage time during the month for Group 1 stations.

One area which improved significantly this month was the operator error category. The total time lost due to this cause was only 1:40 hours in March—a whopping 29:14 hours below the February total—and represents less than 2 percent of the total lost time reported during the month.

Equipment failures caused 19:51 hours of lost time, accounting for 22.5 percent of time lost by Group 1 stations from all causes.

Operating time lost over the past year on all Group 1 stations due to the three generally most common failures—line-cable-microwave, equipment, and poor propagation—is indicated graphically in Figures 4A, 4B, and 4C, respectively. Time lost due to all troubles is indicated in Figure 4D. Both the total time lost per month and the average for the 12-month period are indicated for each of the separate trouble categories listed and for all categories combined. As may be seen from the graph, during the month of March total time lost due to equipment failure and poor propagation was below the 12-month average, whereas time lost due to line-cable-microwave failures was slightly above the average. Total time lost due to all troubles combined was more than 20 percent below the 12-month average.

The reliability of each of the Group 1 circuits or stations in March, together with a 12-month average for each, is shown in Table 4. Included in the table is (a) a detailed breakdown of the scheduled operating time, (b) the duration of each interruption, (c) the trouble category responsible for each interruption, and (d) the total time lost in each trouble category.

The number of interruptions logged in each of the trouble categories by the individual circuits or stations is presented in Table 5. Transmit and receive path totals are listed separately.

A comparison of the number of interruptions in each trouble category over the 6-month period ending in March is given in Table 6. The average duration, in minutes, of the interruptions is shown in the right-hand column of Table 6 for each of the stations or circuits.

As stated previously, those circuits which have demonstrated a widely fluctuating degree of reliability or have chronically degraded the performance of the NASCOM Network are treated in more detail in later sections of this report. Circuits normally in the Network but temporarily decommissioned or not utilized except for periodic testing, or those circuits performing with a very high degree of reliability, are not analyzed, even though they are included in the list of stations or circuits in Table 1.

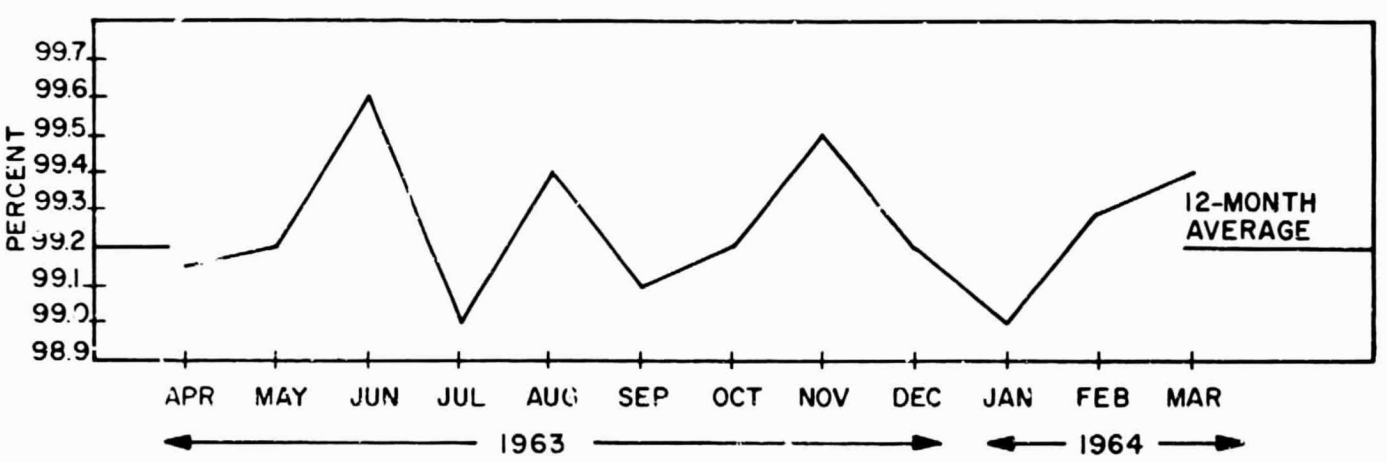


Figure 3. Network Reliability (Percent), Group 1 Stations

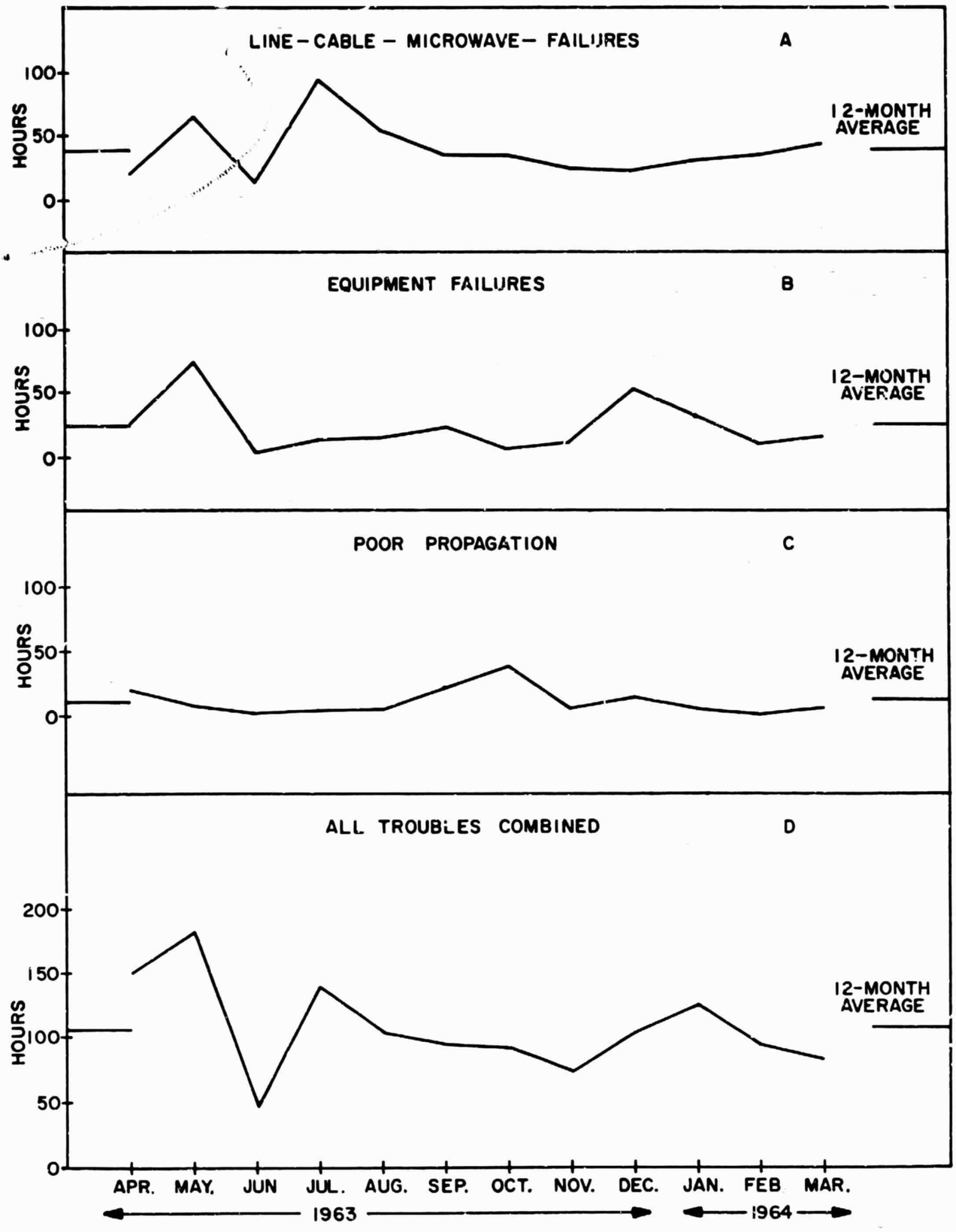


Figure 4. Time Lost by Trouble Categories (Hours), Group 1 Stations

Table 4

Teletype Circuit Lost Time by Trouble Categories—Group 1 Stations

CIRCUIT	STATION	TROUBLE CATEGORIES* (Hours and Minutes)											TOTAL LOST TIME (Hours and Minutes)	SCHED OPERATING TIME (Hours)	RELIABILITY (Percent)	
		A	B	C	D	E	F	G	I	K	M	P			Mar. 1964	12-Month Average
7005-01T	AADE	:15	3:59	-	:20	4:14	-	1:55	-	-	:14	1:18	12:15	738	98.3	98.6
-01R	AADE	1:07	3:43	1:10	-	2:45	-	2:30	-	-	-	1:18	12:33	738	98.3	98.9
-01T	ACRO	1:33	10:24	-	:20	4:57	-	-	-	-	-	-	17:14	231	92.5	**94.8
-01R	ACRO	:46	10:19	-	-	2:30	-	-	-	-	-	-	13:35	231	94.1	94.9
-01T	AMUC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-01R	AMUC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7005-02T	PCTN	-	2:16	-	-	-	-	:15	-	-	-	-	2:31	66	96.2	98.6
-02R	PCTN	-	-	-	-	-	-	-	-	-	-	-	:00	66	100.0	99.0
-02T	PHAW	:15	2:00	-	-	2:04	-	-	-	-	:31	-	4:50	326	98.5	99.3
-02R	PHAW	-	2:00	-	-	-	-	-	-	-	:31	-	2:31	326	99.2	99.6
7005-04T	GCAL	-	-	-	-	-	-	-	-	-	-	-	:00	735	100.0	99.9
-04R	GCAL	-	:43	-	-	-	2:55	-	-	-	-	-	3:38	735	99.5	99.8
-05T	GGYM	:02	1:23	-	-	-	-	-	-	-	:02	-	1:27	676	99.8	98.6
-05R	GGYM	-	:07	-	-	-	-	-	-	-	-	-	:07	676	99.9	98.2
-06T	GWHS	-	-	-	-	-	-	-	-	-	-	-	:00	181	100.0	99.6
-06R	GWHS	-	:10	-	-	-	-	-	-	-	-	-	:10	181	99.9	99.6
-07T	GTEX	-	2:10	-	-	-	-	-	-	-	-	-	2:10	198	98.9	99.9
-07R	GTEX	-	2:10	-	-	-	-	-	-	-	-	-	2:10	198	98.9	99.9
7005-08T	GEGL	-	-	-	-	-	-	-	-	-	-	-	:00	272	100.0	99.8
-08R	GEGL	-	:16	-	-	-	-	-	-	-	-	-	:16	272	99.9	99.5
-11T	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0	99.8
-11R	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0	99.6
-13T	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0	**99.8
-14T	GMCC	-	:10	-	-	-	-	-	-	-	-	-	:10	319	99.9	***99.9
-15T	GMCC	-	:10	-	-	-	-	-	-	-	-	-	:10	744	99.9	99.2
-15R	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	744	100.0	99.5
-17T	LCYI	-	-	:15	-	:48	-	-	-	-	-	-	1:03	168	99.4	99.8
-17R	LCYI	:20	:15	-	-	:20	-	-	-	-	-	-	:55	168	99.5	98.0

Table 4 (Continued)

Teletype Circuit Lost Time by Trouble Categories—Group 1 Stations

CIRCUIT	STA-TION	TROUBLE CATEGORIES* (Hours and Minutes)											TOTAL LOST TIME (Hours and Minutes)	SCHED OPER-ATING TIME (Hours)	RELIABILITY (Percent)	
		A	B	C	D	E	F	G	I	K	M	P			Mar. 1964	12-Month Average
7005-17T	LKNO	-	-	:15	-	-	-	-	-	-	-	-	:15	170	99.9	97.9
-17R	LKNO	:10	1:15	-	-	:20	-	:55	-	-	-	-	2:40	170	98.4	98.0
-18T	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0	***99.5
-19T	GMCC	-	:10	-	-	-	-	-	-	-	-	-	:10	319	99.9	***99.8
-22T	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	744	100.0	99.8
-22R	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0	***99.6
-23T	GMCC	-	-	-	:15	:45	-	-	-	-	-	-	1:00	744	99.9	99.8
-23R	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0	***99.7
7005-30T	GBDA	-	1:05	-	-	:43	-	-	-	-	-	-	1:48	195	99.1	99.6
-30R	GBDA	-	:20	-	-	-	-	-	-	-	-	-	:20	195	99.8	99.6
-31T	GBDA	-	:20	-	-	:25	-	-	-	-	-	-	:45	195	99.6	99.6
-31R	GBDA	-	:20	-	-	-	:55	-	-	-	-	-	1:15	195	99.5	99.7
TOTALS		4:28	45:45	1:40	:55	19:51	3:50	5:35	-	-	1:18	2:36	85:58	13,830	99.4	99.2

*Legend:

A - No trouble found
B - Line-cable-microwave
C - Operator error
D - Equipment adjustment
E - Equipment failure
F - Wiring defect
G - Poor propagation
I - Interference
K - Frequency change
M - Maintenance
P - Power failure

**ACRO—4-month average is shown instead of the normal 12-month average.
***GMCC-13T, 14T, 18T, 19T, 22R, 23R—a 7-month average is shown instead of the 12-month average.

Table 5

Teletype Circuit Interruptions by Trouble Categories—Group 1 Stations

CIRCUIT	STA-TION	TROUBLE CATEGORIES* (Number of Interruptions)											
		A	B	C	D	E	F	G	I	K	M	P	TOTAL
7005-01T	AADE	1	7	-	1	3	-	2	-	-	1	2	17
-01R	AADE	2	7	1	-	4	-	3	-	-	2	-	19
-01T	ACRO	3	6	-	1	4	-	-	-	-	-	-	14
-01R	ACRO	1	6	-	-	3	-	-	-	-	-	-	10
-01T	AMUC	-	-	-	-	-	-	-	-	-	-	-	0
-01R	AMUC	-	-	-	-	-	-	-	-	-	-	-	0
-02T	PCTN	-	3	-	-	-	-	1	-	-	-	-	4
-02R	PCTN	-	-	-	-	-	-	-	-	-	-	-	0
-02T	PHAW	1	2	-	-	1	-	-	-	-	1	-	5
-02R	PHAW	-	2	-	-	-	-	-	-	-	1	-	3
-04T	GCAL	-	-	-	-	-	-	-	-	-	-	-	0
-04R	GCAL	-	1	-	-	-	2	-	-	-	-	-	3
-05T	GGYM	1	5	-	-	-	-	-	-	-	1	-	7
-05R	GGYM	-	1	-	-	-	-	-	-	-	-	-	1
-06T	GWHS	-	-	-	-	-	-	-	-	-	-	-	0
-06R	GWHS	-	1	-	-	-	-	-	-	-	-	-	1
-07T	GTEX	-	1	-	-	-	-	-	-	-	-	-	1
-07R	GTEX	-	1	-	-	-	-	-	-	-	-	-	1
-08T	GEGL	-	-	-	-	-	-	-	-	-	-	-	0
-08R	GEGL	-	1	-	-	-	-	-	-	-	-	-	1
-11T	GMCC	-	-	-	-	-	-	-	-	-	-	-	0
-11R	GMCC	-	-	-	-	-	-	-	-	-	-	-	0
-13T	GMCC	-	-	-	-	-	-	-	-	-	-	-	0
-14T	GMCC	-	1	-	-	-	-	-	-	-	-	-	1
-15T	GMCC	-	1	-	-	-	-	-	-	-	-	-	1
-15R	GMCC	-	-	-	-	-	-	-	-	-	-	-	0
-17T	LCYI	-	-	1	-	1	-	-	-	-	-	-	2
-17R	LCYI	2	1	-	-	1	-	-	-	-	-	-	4
-17T	LKNO	-	-	1	-	-	-	-	-	-	-	-	1
-17R	LKNO	1	2	-	-	1	-	1	-	-	-	-	5
-18T	GMCC	-	-	-	-	-	-	-	-	-	-	-	0
-19T	GMCC	-	1	-	-	-	-	-	-	-	-	-	1
-22T	GMCC	-	-	-	-	-	-	-	-	-	-	-	0
-22R	GMCC	-	-	-	-	-	-	-	-	-	-	-	0
-23T	GMCC	-	-	-	1	2	-	-	-	-	-	-	3
-23R	GMCC	-	-	-	-	-	-	-	-	-	-	-	0
-30T	GBDA	-	3	-	-	2	-	-	-	-	-	-	5
-30R	GBDA	-	1	-	-	-	-	-	-	-	-	-	1
-31T	GBDA	-	1	-	-	1	-	-	-	-	-	-	2
-31R	GBDA	-	1	-	-	1	-	-	-	-	-	-	2
	TOTALS	12	56	3	3	24	2	7	0	0	6	2	115

*Legend:

A - No trouble found
B - Line-cable-microwave
C - Operator error
D - Equipment adjustment
E - Equipment failure
F - Wiring defect
G - Poor propagation
I - Interference
K - Frequency change
M - Maintenance
P - Power failure

Table 6

Number of Teletype Interruptions—Group 1 Stations

CIRCUIT	STATION	NUMBER OF INTERRUPTIONS						AVERAGE*
		OCT 1963	NOV 1963	DEC 1963	JAN 1964	FEB 1964	MAR 1964	
7005-01	AADE	46	16	8	24	12	36	41
-01	ACRO	-	-	32	30	32	24	77
-01	AMUC	8	6	8	7	10	-	0
7005-02	PCTN	7	4	2	6	2	4	38
-02	PHAW	18	2	3	9	2	8	55
7005-04	GCAL	9	3	1	5	2	3	72
7005-05	GGYM	13	20	8	17	14	8	09
-06	GWHS	3	-	-	5	-	1	10
-07	GTEX	1	-	-	-	1	2	130
-08	GEGL	6	2	4	-	-	1	16
-11	GMCC	-	1	-	9	2	-	0
-13	GMCC	-	-	-	2	1	-	0
-14	GMCC	-	-	-	-	-	1	10
-15	GMCC	2	-	1	7	4	1	10
-17	LCYI	5	13	8	17	4	3	20
-17	LKNO	6	12	12	7	-	6	29
-18	GMCC	-	2	-	2	1	-	0
-19	GMCC	-	1	-	1	-	1	10
-22	GMCC	1	7	2	18	2	-	0
-23	GMCC	4	1	0	5	11	3	20
-30	GBDA	1	5	2	-	1	6	21
-31	GBDA	2	3	5	1	1	4	30
	TOTALS	161	106	114	172	102	115	45

*Average duration of interruption to the nearest minute in March.

Summary-Group 2 Stations

The Group 2 NASCOM Network stations/circuits are listed in their entirety in Table 2, presented earlier. The geographical locations of these stations/circuits and their respective paths are shown on the map in Figure 2.

The reliability of the Group 2 stations/circuits has been consistently high, with the exception of the seven stations or circuits listed in Table 7, below. These seven circuits, all of which employ HF radio for the major part of their path, have exhibited wide variations in reliability over the past several months. These irregularities in circuit performance have necessitated more detailed analysis in order to determine and correct the underlying causes of the abnormal performance.

Table 7

Teletype Circuit Reliability (Percent) for Seven Group 2 Stations

LOCATION	CIRCUIT DESIG.	OCT 1963	NOV 1963	DEC 1963	JAN 1964	FEB 1964	MAR 1964	SIX-MONTH AVERAGE
Johannesburg, Africa	RA-30	91.7	87.2	95.2	90.1	91.6	89.6	90.9
Johannesburg, Africa	RA-54	94.2	88.3	93.2	86.2	87.8	87.4	89.5
Johannesburg, Africa	Back-Up	-	80.9	79.8	85.3	81.2	73.5	80.7
Lima, Peru	NS-111	90.5	95.9	93.1	90.6	89.8	92.0	92.0
Quito, Ecuador	NS-108	89.6	92.3	94.3	87.8	90.7	88.7	90.6
Santiago, Chile	NS-109	84.8	90.7	88.8	82.4	83.8	88.3	86.5
*Woomera, Australia	RA-35	96.1	95.4	95.8	99.0	97.7	92.6	96.1

*The Woomera (RA-35) circuit was made all-cable on December 13, 1963. However, since March 4, 1964, HF radio has been employed on an alternate basis between Woomera and Hawaii.

The reliability of each of the seven stations or circuits analyzed is shown, for the six-month period from October 1963 through March 1964, in Table 7. Although Woomera (RA-35) declined in reliability by 5.1 percentage points, it still maintained the highest index in March (92.6 percent). Lima (NS-111) was a close second, with an index of 92.0 percent. Lima (NS-111) and Santiago (NS-109) were the only two stations which showed an improvement in reliability, with Santiago (NS-109) having the greatest gain—increasing from 83.8 percent in February to 88.3 percent in March. The Johannesburg (Back-Up) circuit experienced the worst decline, as well as the lowest reliability, of the seven circuits, dropping from 81.2 percent in February to 73.5 percent in March.

The average reliability of the Group 2 circuits being considered here is shown graphically for the one-year period from April 1963 through March 1964, in Figure 5. As indicated, there has been a continuous decline in reliability over the past three months, the index declining from an all-time high of 94.2 percent in December 1963, to 87.4 percent

in March—the lowest for the year. The March average is 2.8 percentage points below the yearly average: 90.2 percent.

The combined circuit lost time by major trouble categories over the same one-year period is shown by the four graphs in Figure 6A, B, C, and D. The three major categories are (A) frequency change, (B) equipment failure, and (C) for propagation. The combined outages for all trouble categories are listed in Figure 6D. As indicated therein, the increasing trend in total circuit outage began in December 1963, and continued through March, 1964. December's outages totalled only 612 hours; March's totalled 1320 hours—the highest since April 1963. March's figure represents an increase of 115.7 percent in total circuit outages in the first three months of 1964. Poor propagation, which accounted for the major part of these outages, increased 188 percent during this same period, jumping from 293 hours in December to 844 hours in March. A relatively small increase occurred in equipment-failure lost time, which totalled 120 hours in March. On the other hand, a relatively small decrease occurred in frequency-change outages, which declined from 145 hours in February to 143 hours in March.

The performance of individual circuits is summarized in Tables 8, 9, 10, and 11. The time lost due to each of 11 trouble categories is shown in Table 8, the figures for the transmit path and receive path being shown separately for each of the seven Group 2 circuits. Total lost time, total operating time, and reliability (in percentage) are also shown for each path (in the three columns at the right of the table). The number of individual circuit interruptions which caused the outages enumerated in Table 8, are given in Table 9 under their respective categories.

The combined number of teletype circuit interruptions on each path for each month in the six-month period from October 1963 through March 1964 is given in Table 10. The average length of the interruptions in March is shown in the extreme right-hand column.

A general summary of the combined performance of both paths of each of the seven circuits for the 3-month period of January, February, and March 1964, is presented in Table 11. The column headings covering the various areas of circuit performance are self-explanatory. Particular attention is directed in this table to the extreme right-hand column, which denotes the average operating time without interruption for each circuit. This data is of obvious importance, especially in the handling of ephemerides and tracking data over prolonged periods of time and in those cases where interruptions may be costly, in both circuit time and accuracy.

As may be seen from the data, Woomera (RA-35) had the longest average uninterrupted operating period: 14 hours. This was attained in spite of a four-fold increase in time lost when the circuit was transferred, as pointed out earlier, from cable to HF radio (on March 4, 1964). The second best showing in uninterrupted operation was made by Johannesburg RA-54, which had 9:45 hours of uninterrupted operation. Lima (NS-111) followed, with 7:16 hours. The Johannesburg Back-Up circuit had by far the worst showing, with only 2:15 hours of average uninterrupted operating time. Santiago (NS-109) had the next lowest, with 5:00 hours; this, however, was an improvement of nearly two hours over the February figure.

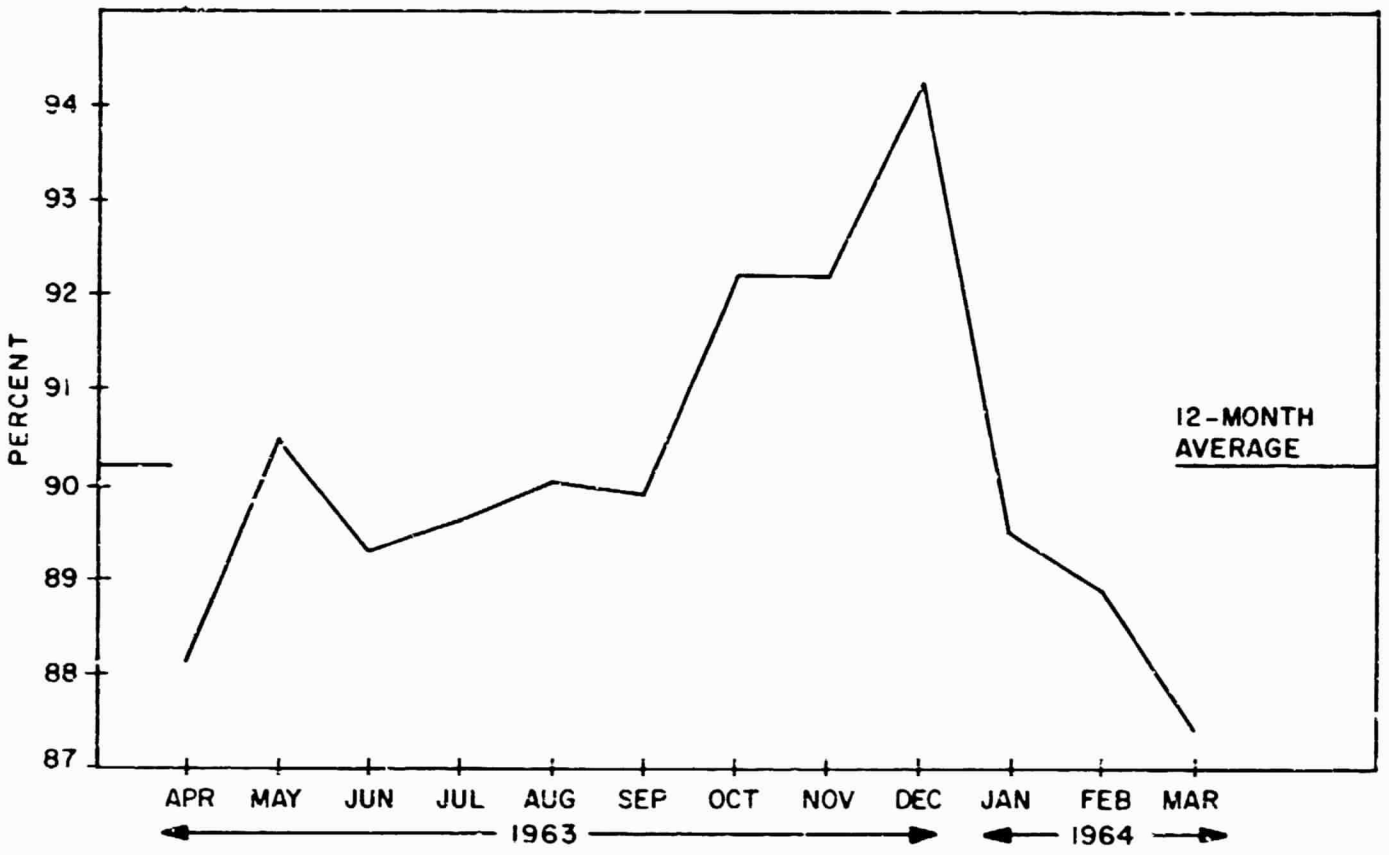


Figure 5. Network Reliability (Percent), Group 2 Stations

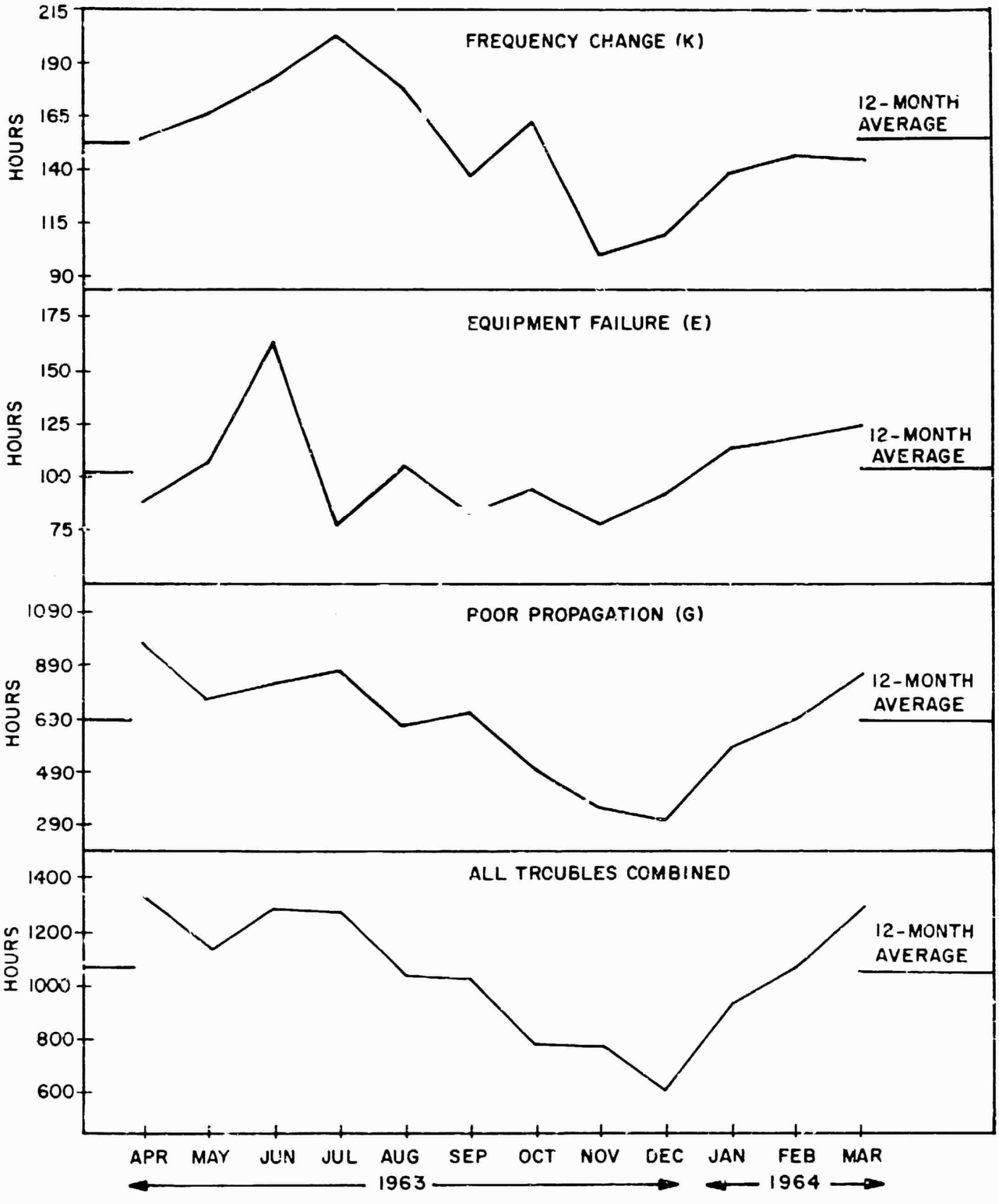


Figure 6. Time Lost by Trouble Categories (Hours), Group 2 Stations

Table 8

Teletype Circuit Lost Time by Trouble Categories for March—
(Transmit and Receive Paths Listed Separately)
Group 2 Stations

STATION	CIRCUIT	TROUBLE CATEGORIES*											TOTAL LOST TIME (Hours & Min.)	SCHED OPER. TIME (Hours)	RELIABILITY PERCENTAGE
		A	B	C	D	E	F	G	I	K	M	P			
Joburg	RA-30T	:15	:10	-	:15	4:50	-	62:00	-	4:10	-	6:00	77:40	744	89.6
	30R	:15	:10	-	:15	4:55	-	62:10	-	4:10	:20	6:00	78:15	744	89.5
Joburg	RA-54T	3:20	8:40	-	-	16:25	-	65:40	-	:15	-	6:40	101:00	744	86.4
	54R	2:15	2:00	:30	-	12:30	-	65:35	-	:15	:15	6:40	90:00	744	87.9
Joburg	Back-upT	4:15	11:40	-	-	6:15	-	152:40	-	20:05	-	1:35	196:30	744	73.6
	-upR	4:15	13:30	-	-	6:15	-	152:40	-	20:20	-	1:35	198:35	744	73.3
Lima	NS-111T	3:00	3:00	10:05	-	2:05	-	22:35	:25	15:00	-	3:20	59:30	744	92.0
	111R	:45	3:05	2:30	-	2:40	-	35:00	1:05	12:10	-	2:15	59:30	744	92.0
Quito	NS-108T	1:00	3:00	-	:15	6:10	:40	66:45	-	16:50	-	3:05	97:45	744	86.9
	108R	:25	3:15	:20	-	7:10	-	47:50	-	9:45	-	2:35	71:20	744	90.4
Santiago	NS-109T	3:50	3:00	:45	:25	7:55	:55	48:45	8:40	21:35	2:00	2:50	100:40	744	86.5
	109R	:10	3:00	-	-	9:00	-	40:45	:55	17:25	-	2:40	73:55	744	90.1
Woomera	RA-35T	4:30	24:40	-	-	12:35	-	11:00	-	:35	-	:45	54:05	744	92.7
	35R	4:20	24:00	-	-	21:10	-	10:20	-	:35	-	:45	61:10	744	91.8
	TOTALS	32:35	103:10	14:10	1:10	119:55	1:35	843:45	11:05	143:10	2:35	46.45	1319:55	10413	87.4 Avg.

*Legend:

A - No trouble found
B - Line-cable-microwave
C - Operator error
D - Equipment adjustment
E - Equipment failure
F - Wiring defect
G - Poor propagation
I - Interference
K - Frequency change
M - Maintenance
P - Power failure

Table 9

Teletype Circuit Interruptions by Trouble Categories for March—Group 2 Stations

STATION	CIRCUIT	TROUBLE CATEGORIES* (Number of Interruptions)											
		A	B	C	D	E	F	G	I	K	M	P	TOTAL
Joburg	RA-30T	2	1	-	1	10	-	69	-	14	-	2	99
	30R	2	1	-	1	11	-	70	-	14	1	2	102
Joburg	RA-54T	4	9	-	-	21	-	36	-	1	-	4	75
	54R	2	4	1	-	16	-	35	-	1	1	4	64
Joburg	Back-upT	8	9	-	-	11	-	170	-	69	-	3	270
	-upR	8	11	-	-	11	-	170	-	70	-	3	273
Lima	NS-111T	4	1	6	1	8	-	23	2	57	-	7	109
	111R	6	2	2	-	5	-	39	3	51	-	4	112
Quito	NS-108T	4	1	-	-	11	2	80	-	63	-	7	168
	108R	3	2	1	-	15	-	76	-	42	-	4	143
Santiago	NS-109T	10	1	1	1	21	1	59	9	66	2	5	176
	109R	1	1	-	-	20	-	56	2	63	-	4	147
Woomera	RA-35T	7	15	-	-	13	-	7	-	2	-	1	45
	35R	11	15	-	-	20	-	6	-	2	-	1	55
	TOTALS	72	73	11	4	193	3	896	16	515	4	51	1838

*Legend:

A - No trouble found
B - Line-cable-microwave
C - Operator error
D - Equipment adjustment
E - Equipment failure
F - Wiring defect
G - Poor propagation
I - Interference
K - Frequency change
M - Maintenance
P - Power failure

Table 10

Number of Teletype Circuit Interruptions
(Transmit and Receive Paths Combined)
Group 2 Stations

STATION	CIRCUIT	NUMBER OF INTERRUPTIONS						
		OCT 1963	NOV 1963	DEC 1963	JAN 1964	FEB 1964	MAR 1964	AVERAGE*
Joburg	RA-30	154	142	114	150	134	201	46
Joburg	RA-54	89	147	85	171	133	139	82
Joburg	Back-up	-	-	336	379	407	543	43
Lima	NS-111	277	164	173	241	249	220	32
Quito	NS-108	233	209	194	245	217	311	33
Santiago	NS-109	338	310	318	384	382	323	32
Woomera	RA-35	71	95	56	25	36	100	69
	TOTALS	1162	1067	1276	1595	1558	1837	43

*Average duration of interruptions to the nearest minute for March 1964.

Table 11

Circuit Performance—January, February, and March
(Transmit and Receive Paths Combined), Group 2 Stations

STATION	CIRCUIT	MONTH	TOTAL NUMBER OF OUTAGES	AVERAGE NUMBER OF OUTAGES PER DAY	AVERAGE LOST TIME PER DAY	SCHEDULED OPERATING HOURS	TOTAL LOST TIME	ACTUAL TIME AVAILABLE TO USER	AVERAGE OPERATING TIME BETWEEN OUTAGES
Johannes-burg	RA-30	JAN	141	4.5	4:30	1488	139:50	1348:10	9:33
		FEB	134	4.6	4:00	1392	116:20	1275:40	9:31
		MAR	187	6.0	5:01	1488	155:55	1332:05	7:07
Johannes-burg	RA-54	JAN	170	5.4	6:40	1488	206:40	1281:20	7:32
		FEB	133	4.5	5:50	1392	169:30	1222:30	9:11
		MAR	133	4.2	6:09	1488	191:00	1297:00	9:45
Johannes-burg	Back-up	JAN	379	13.0	7:04	1488	219:30	1268:30	3:20
		FEB	407	14.0	9:02	1392	262:10	1129:50	2:46
		MAR	500	16.1	12:44	1488	395:05	1092:55	2:15
Lima	NS-111	JAN	203	6.5	4:31	1488	140:10	1347:50	6:38
		FEB	249	8.5	4:53	1392	141:35	1250:25	5:01
		MAR	188	6.0	3:50	1488	119:00	1369:00	7:16
Quito	NS-108	JAN	211	6.8	5:52	1488	181:55	1306:05	6:11
		FEB	217	7.4	4:27	1392	129:20	1262:40	5:49
		MAR	247	7.9	5:27	1488	169:05	1318:55	5:24
Santiago	NS-109	JAN	294	9.4	6:59	1488	261:50	1226:10	4:10
		FEB	382	13.1	7:46	1392	225:25	1166:35	3:03
		MAR	262	8.4	5:37	1488	174:35	1311:55	5:00
Woomera	RA-35	JAN	25	.8	:30	1488	15:45	1472:15	58:53
		FEB	36	1.2	1:08	1392	33:00	1359:00	37:45
		MAR	98	3.1	3:43	1488	115:15	1372:20	14:00

NOTE: All times shown are in hours and minutes.

TELETYPE PERFORMANCE—DISCUSSION AND ANALYSES OF TWENTY STATIONS

General

This section of the March NASCOM Network reliability report summarizes the performance of the several teletype circuits on an individual basis for January, February and March 1964. The analysis of each station, or circuit, compares the applicable trouble categories and makes a comparison of the realized reliability on both the transmit and receive paths for those months. For convenience in making the analysis, and as previously stated, analysis is first made of the Group 1 stations followed by that of the Group 2 stations.

Graphical presentations of the operational reliabilities are included for several of the circuits. Circuits selected for graphical analysis are those whose reliability characteristics changed significantly over the past 12-month period (April 1963-March 1964); circuits which have shown quite consistently a high degree of reliability are not graphically analyzed. Where several stations are on the same circuit, only that station which is the most distant from Goddard Space Flight Center is analyzed graphically. The circuits selected for graphical analysis may change from time to time according to the reliability characteristics of the circuits and the network.

Group 1 Stations

Adelaide (AADE-01)
Bermuda (GBDA-30 and GBDA-31)
California (GCAL-04)
Cape Kennedy (AMR) and Mission Control Center (MCC): (GMCC-11, GMCC-13, GMCC-14, GMCC-15, GMCC-18, GMCC-19, GMCC-22, GMCC-23)
Canton (PCTN-02/68)
Carnarvon (ACRO-01)
Eglin AFB (GEGL-08)
Grand Canary Island (LCYI-17)
Guaymas (GGYM-05)
Hawaii (PHAW-02/67)
Kano (LKNO-17)
Texas (GTEX-07)
White Sands (GWHS-06)

Outage Time and Reliability - Adelaide

AADE-01 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
A No trouble found	-	:31	:15	-	-	1:07
B Line-cable-microwave	:37	1:07	3:59	2:57	1:29	3:43
C Operator error	1:19	-	-	1:19	-	1:10
D Equipment adjustment	1:15	2:27	:20	-	-	-
E Equipment failure	-	-	4:14	1:25	2:02	2:45
G Poor propagation	1:16	-	1:55	1:16	-	2:30
M Maintenance	-	:19	:14	-	-	-
P Power failure	:19	2:25	1:18	:19	2:25	1:18
TOTAL OUTAGE	4:46	6:49	12:15	7:16	5:56	12:33
SCHED OPER TIME	744	696	738	744	696	738
RELIABILITY (Percent)	99.4	99.0	98.3	99.0	99.1	98.3

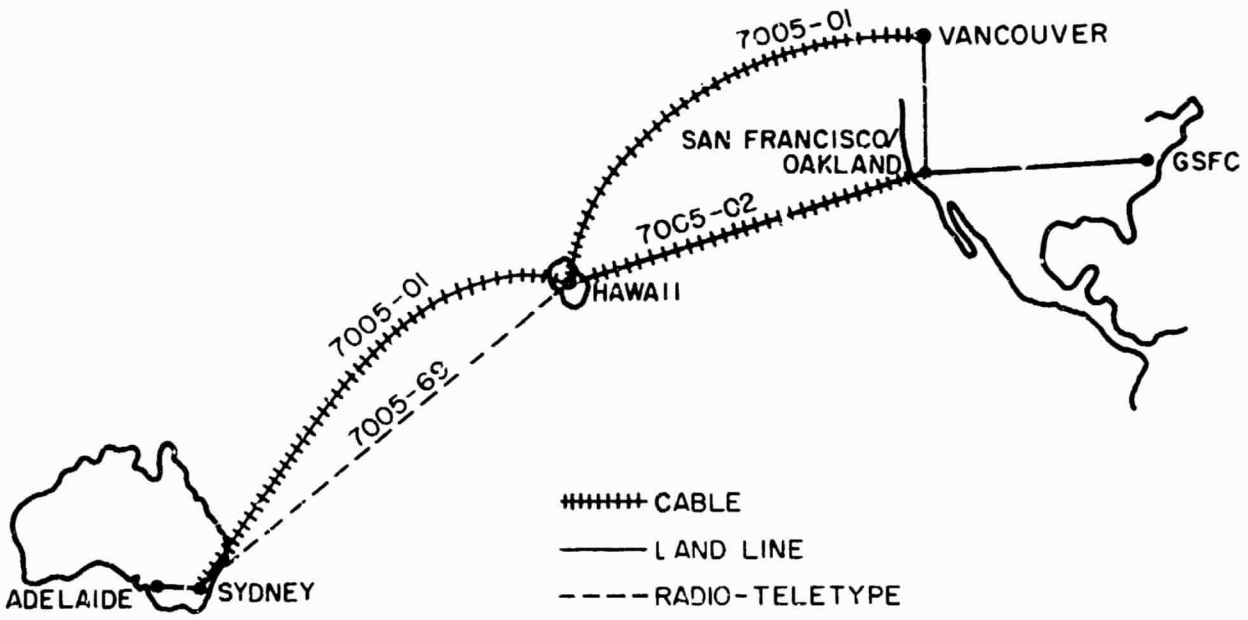
Summary

The reliability of the AADE-01 circuit declined further during March. Together, the transmit and receive paths accrued approximately twice as many hours of outage time as in February.

The foremost causes of transmit path interruptions were line-cable-microwave and equipment failures. The longest outage due to equipment failure occurred on March 23, lasted 2 hours, and was due to failure of a transmitter unit at San Francisco. The longest outage due to line-cable-microwave troubles occurred on March 14, was due to a carrier fault in Oakland, and lasted 1:35 hours. The next most serious line-cable-microwave outage on this path occurred when the Alaskan earthquake, on March 28, severed the Vancouver-Honolulu-Sydney cable (at approximately 1010Z). The circuit was patched over to the AADE-02 Sydney-Honolulu radio path after a 35-minute interruption. The undersea cable remained severed throughout the remainder of the month. However, on March 30, an alternate-route circuit was reactivated: Mackay Radio established a direct radio link between San Francisco and Sydney. This link will continue to be used until repairs have been completed on the undersea cable.

The receive path was out of service for 1:45 hours on March 13 because of a faulty FRXD-type transmitter unit at San Francisco. An unnecessary outage of 1:10 hours was incurred on March 28, after the undersea cable break. The patch-over from the -01 cable path to the -02 radio facilities was delayed on the receive portion because an R-T unit in the Honolulu office had been switched off.

No graphical analysis is shown for AADE-01 (see page 22).



Outage Time and Reliability - Bermuda

GBDA-30 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
B Line-cable-microwave	-	-	1:05	-	:13	:20
E Equipment failure	-	-	:43	-	-	-
TOTAL OUTAGE	0:00	0:00	1:48	0:00	:13	:20
SCHED OPER TIME	161	140	195	161	140	195
RELIABILITY (Percent)	100.0	100.0	99.1	100.0	99.8	99.8

Outage Time and Reliability - Bermuda

GBDA-31 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
B Line-cable-microwave	-	:25	:20	-	-	:20
E Equipment failure	-	-	:25	-	-	-
F Wire defect	-	-	-	-	-	:55
M Maintenance	:03	-	-	-	-	-
TOTAL OUTAGE	:03	:25	:45	0:00	0:00	1:15
SCHED OPER TIME	161	140	195	161	140	195
RELIABILITY (Percent)	99.9	99.7	99.6	100.0	100.0	99.4

Summary

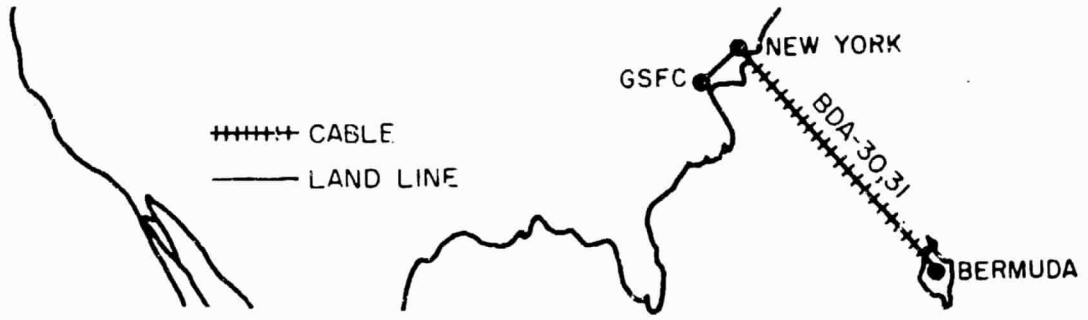
The reliability of the Bermuda (GBDA-30, 31) circuits was slightly lower in March as a result of six interruptions during the month.

On the GBDA-30 transmit path, consecutive interruptions of 18 minutes and 38 minutes on March 20 caused the greatest amount of outage time. A faulty jack at RCA New York and line trouble between New York and Bermuda were respectively responsible for these outages.

On the GBDA-31 receive path, a wiring defect at the Bermuda site was responsible for a 55-minute interruption on March 13. On the transmit path of the 31 circuit, a 25-minute outage occurred on March 16, as a result of a faulty amplifier at Cooper's Island (Bermuda).

Despite these and two other, minor outages, the Bermuda links continued to perform well on the whole during the period.

No graphical analysis is shown for GBDA 30/31 (see page 22).



Outage Time and Reliability - California

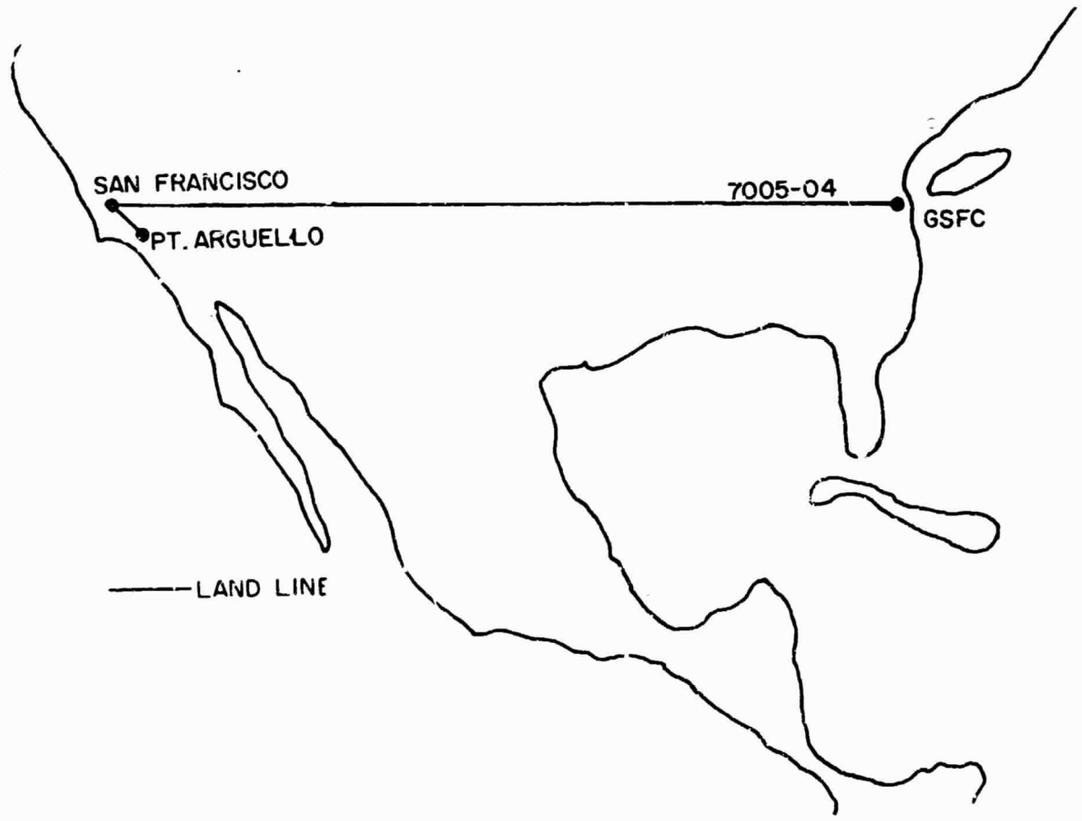
GCAL-04 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
B Line-cable-microwave	:37	-	-	:37	-	:43
E Equipment failure	:17	:06	-	-	-	-
F Wire defect	-	-	-	-	-	2:55
M Maintenance	-	-	-	-	:16	-
P Power failure	:06	-	-	:06	-	-
TOTAL OUTAGE	1:00	:06	0:00	:43	:16	3:38
SCHED OPER TIME	744	691	735	744	691	735
RELIABILITY (Percent)	99.9	99.9	100 0	99.9	99.9	99.5

Summary

The reliability of GCAL-04 was slightly lower in March than it had been in preceding months. Although the transmit path functioned with no apparent interruption, the receive path experienced two outages detrimental to overall reliability. A carrier failure between Chicago and Washington was responsible for 43 minutes of outage time on March 11, and a faulty telephone company leased-line was responsible for 2:55 hours of outage on March 12.

No graphical analysis is shown for GCAL-04 (see page 22).



Outage Time and Reliability - Cape Kennedy (AMR) and Mission Control Center

GMCC-11, GMCC-15 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
A No trouble found	-	:05	-	:15	:05	-
B Line-cable-microwave	5:48	1:22	:10	2:42	:12	-
C Operator error	4:55	24:00	-	4:55	-	-
D Equipment adjustment	:38	-	-	1:34	-	-
E Equipment failure	-	-	-	4:10	-	-
TOTAL OUTAGE	11:21	25:27	:10	13:36	:17	0:00
SCHED OPER TIME	1112	980	1063	1112	980	1063
RELIABILITY (Percent)	98.1	97.4	99.9	98.8	99.9	100.0

Outage Time and Reliability - Mission Control Center

GMCC-13, GMCC-14, GMCC-18, GMCC-19* (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
B Line-cable-microwave	6:06	6:38	:20	-	-	-
E Equipment failure	:05	-	-	-	-	-
TOTAL OUTAGE	6:11	6:38	:20	-	-	-
SCHED OPER TIME	1472	1160	1276	-	-	-
RELIABILITY (Percent)	99.6	99.4	99.9	-	-	-

*These four circuits are transmit only from GSFC to Cape Kennedy.

Outage Time and Reliability - Mission Control Center

GMCC-22, GMCC-23 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
A No trouble found	:07	:09	-	:07	:27	-
B Line-cable-microwave	:24	-	-	1:42	:12	-
D Equipment adjustment	1:05	-	:15	1:05	-	-
E Equipment failure	3:17	2:51	:45	3:17	:45	-
TOTAL OUTAGE	5:33	3:00	1:00	6:11	1:24	0:00
SCHED OPER TIME	1488	1392	1488	736	580	638
RELIABILITY (Percent)	39.6	99.8	99.9	99.2	99.8	100.0

Summary

GMCC-11, GMCC-15

Analyzed jointly, the GMCC-11 and GMCC-15 circuits proved to be extremely reliable during March. No outages of any kind were reported for GMCC-11, and only one failure was reported for GMCC-15. Occurring on the transmit path on March 4, this failure was due to carrier trouble at Orlando, Florida, and was responsible for 10 minutes of lost circuit time—the only time lost during the month.

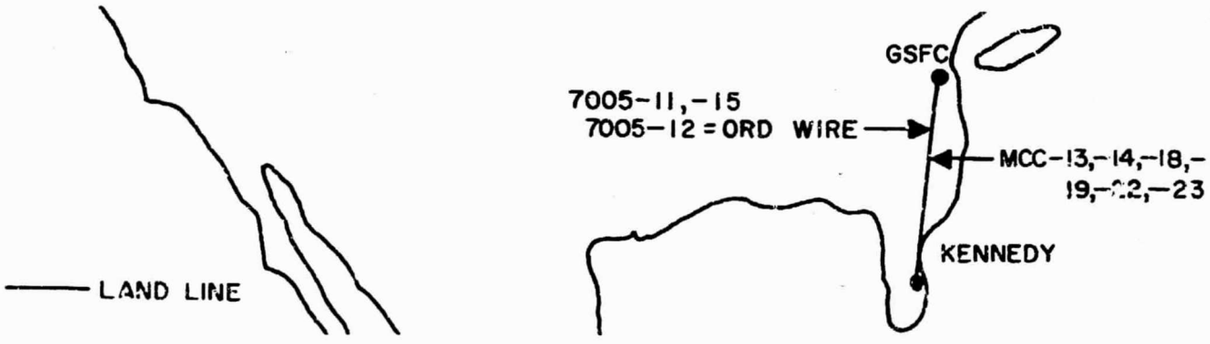
GMCC-13, GMCC-14, GMCC-18, GMCC-19

The four "transmit-only" circuits (GMCC-13, 14, 18, and 19) very nearly attained 100-percent reliability in March. GMCC-13 and GMCC-18 performed without any interruption at all during the month. However, GMCC-14 and GMCC-19 were interrupted for 10 minutes each (or a total of 20 minutes) by the 10-minute carrier failure mentioned above (in the GMCC-15 discussion).

GMCC-22, GMCC-23

The GMCC-22 and GMCC-23 circuits (employed by GSFC and Cape Kennedy for transmission into the NASCOM Network) performed very reliably throughout March. No interruptions whatsoever occurred on GMCC-22. However, two instances of equipment failure and one of failure due to equipment adjustment at GSFC occurred on the transmit path of GMCC-23. As a result of these failures, the transmit path of GMCC-23 was out for one hour during the month.

No graphical analysis is shown for GMCC-11, 13, 14, 15, 18, 19, 22 and 23 (see page 22).



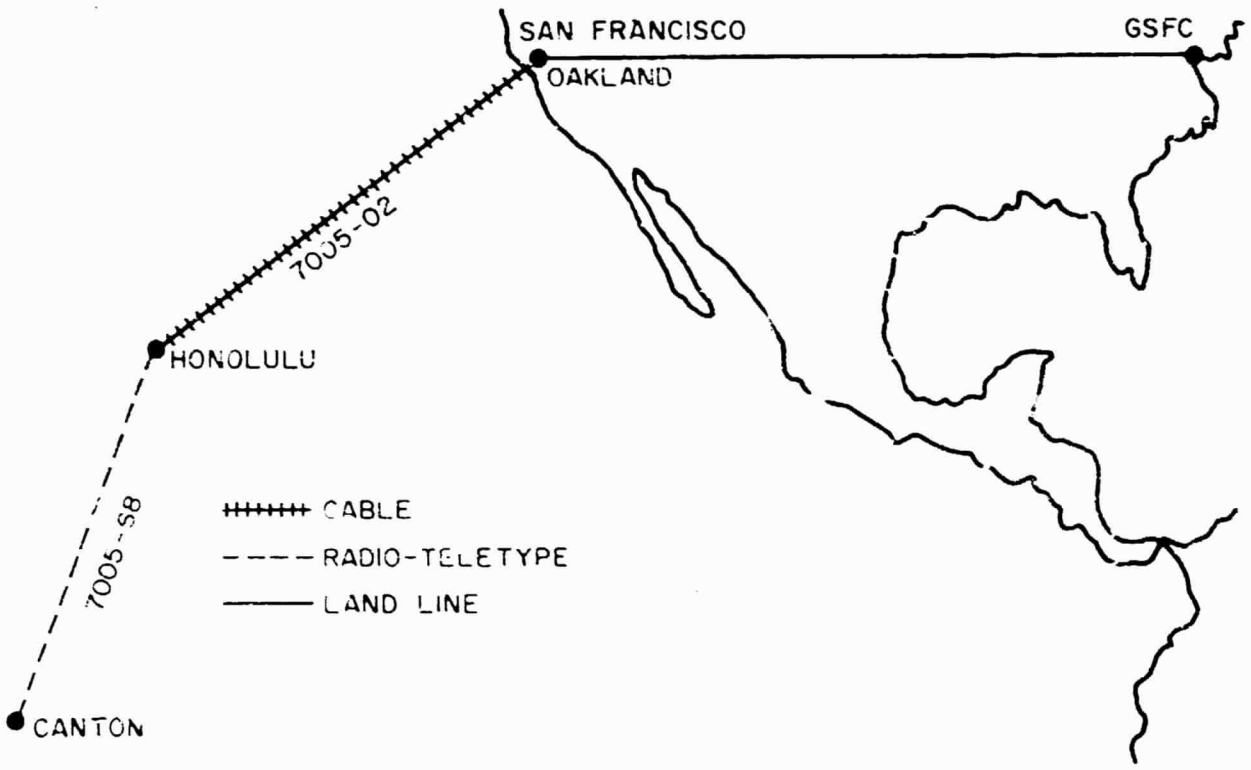
Outage Time and Reliability - Canton Island

PCTN-02/68 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
B Line-cable-microwave	:06	:20	2:16	:06	:20	-
C Operator error	:30	-	-	:40	-	-
E Equipment failure	-	-	-	:05	-	-
G Poor propagation	-	-	:15	-	-	-
TOTAL OUTAGE	:36	:20	2:31	:51	:20	0:00
SCHED OPER TIME	81	57	66	81	57	66
RELIABILITY (Percent)	99.3	99.4	96.2	99.0	99.4	100.0

Summary

The PCTN-02/68 circuit declined markedly in reliability during March. Outages on the transmit path were entirely responsible for the lower level of performance, no outages whatsoever having occurred on the receive path. A single propagation failure and three line-cable-microwave failures accounted for all the outage time. A microwave failure occurred between Denver and Oakland on March 12, and between Molokai and Oahu on March 13. On March 30 the line failed between Chicago and Washington.



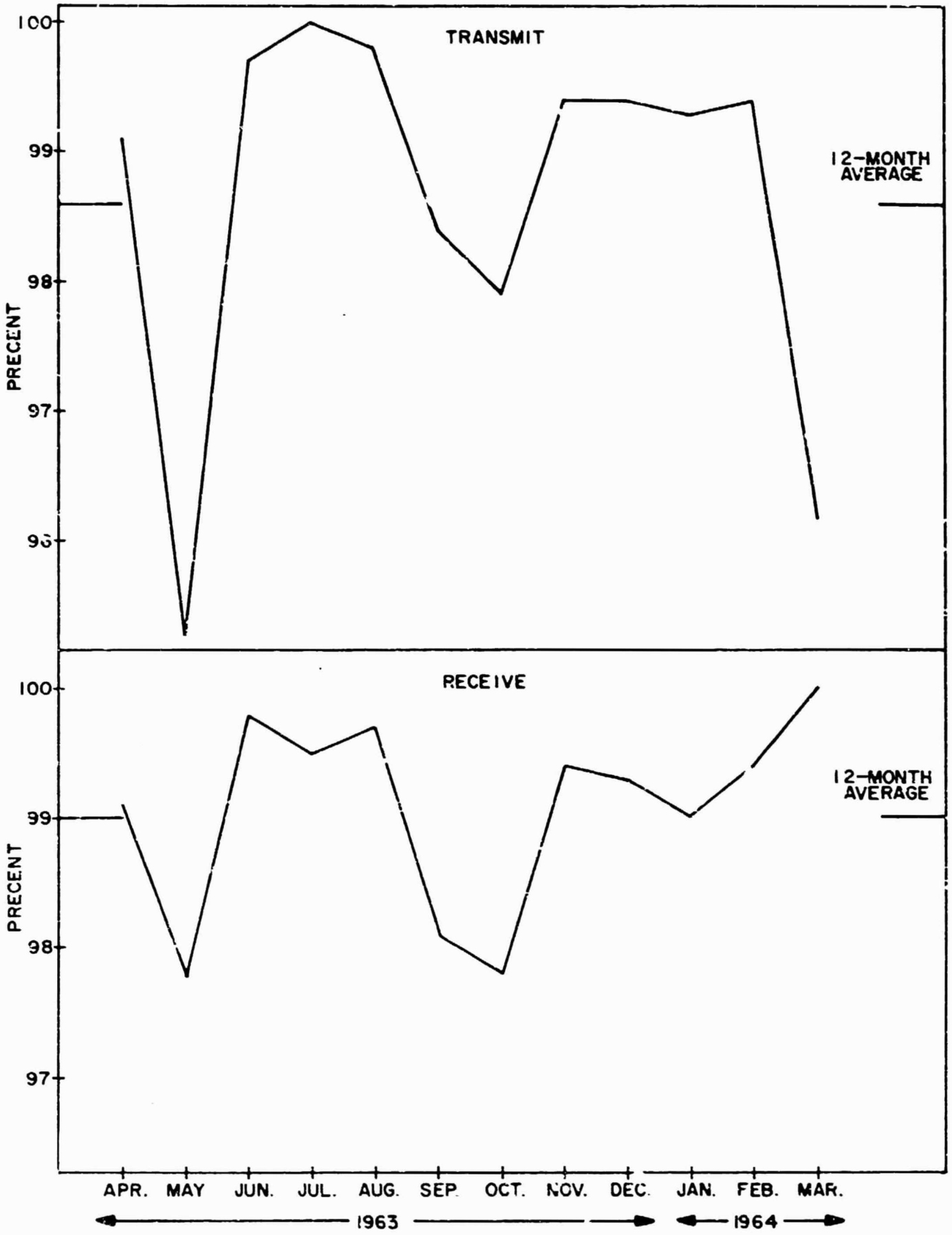


Figure 7. Circuit Reliability of PCTN-02/68

Outage Time and Reliability - Carnarvon

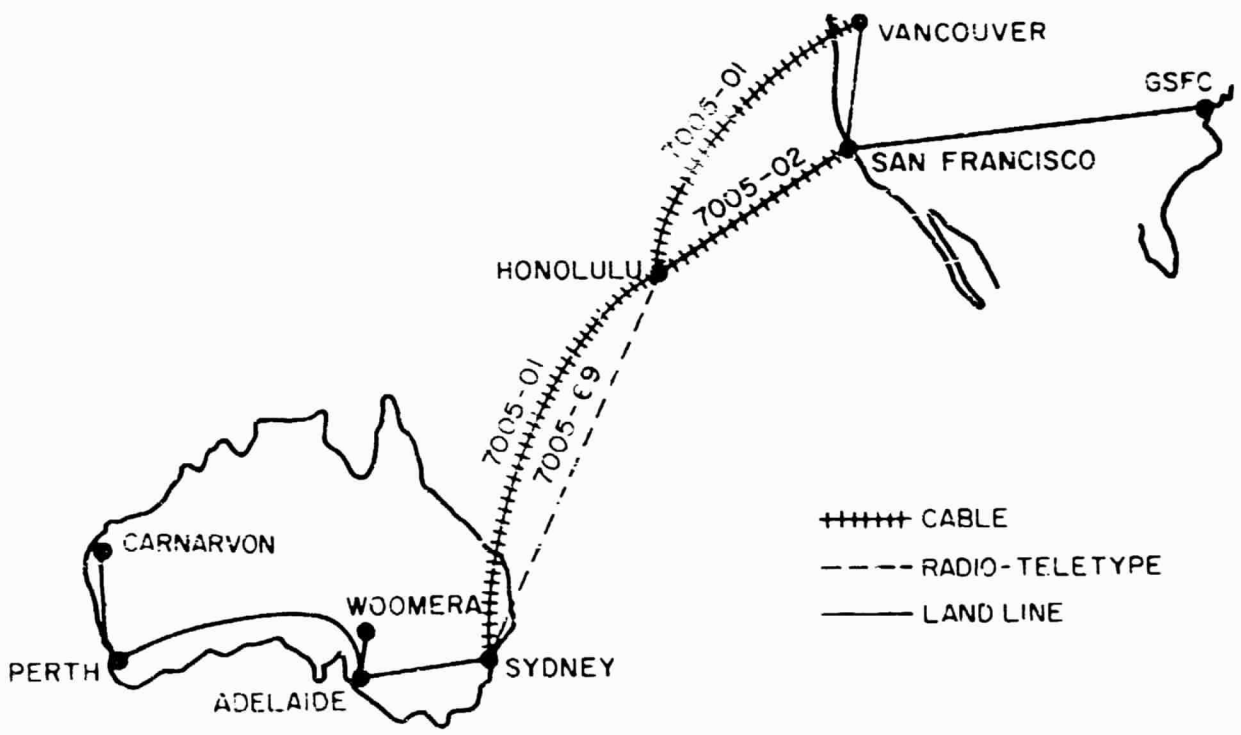
ACRO-01 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
A No trouble found	1:08	-	1:33	-	-	:46
B Line-cable-microwave	2:36	10:00	10:24	2:26	10:22	10:19
C Operator error	2:13	1:25	-	2:13	1:25	-
D Equipment adjustment	-	-	:20	-	-	-
E Equipment failure	1:16	-	4:57	:56	1:17	2:30
M Maintenance	:03	1:09	-	:34	1:09	-
P Power failure	:28	2:28	-	-	2:28	-
TOTAL OUTAGE	7:44	15:02	17:14	6:09	16:41	13:35
SCHED OPER TIME	176	280	231	176	280	231
RELIABILITY (Percent)	95.6	94.6	92.5	96.5	94.0	94.1

Summary

The Carnarvon link continued to perform poorly relative to th ge for the whole Network. Reliability during March deteriorated to a new low on t smit path and within three-tenths of a percent of the low on the receive path. L le-microwave failures during the month were responsible for 60 percent of the t age time on the transmit path and 75 percent on the receive path. A major line failure occurred on both paths of the Perth-Carnarvon section on March 31, when a storm of cyclonic proportions hovered over the area for an extended period. Although the circuit was not completely out of service, operation was severely impaired and deemed to be below commercial quality for 7:30 hours.

No graphical analysis is shown for ACRO-01 (see page 22).



Outage Time and Reliability - Eglin AFB

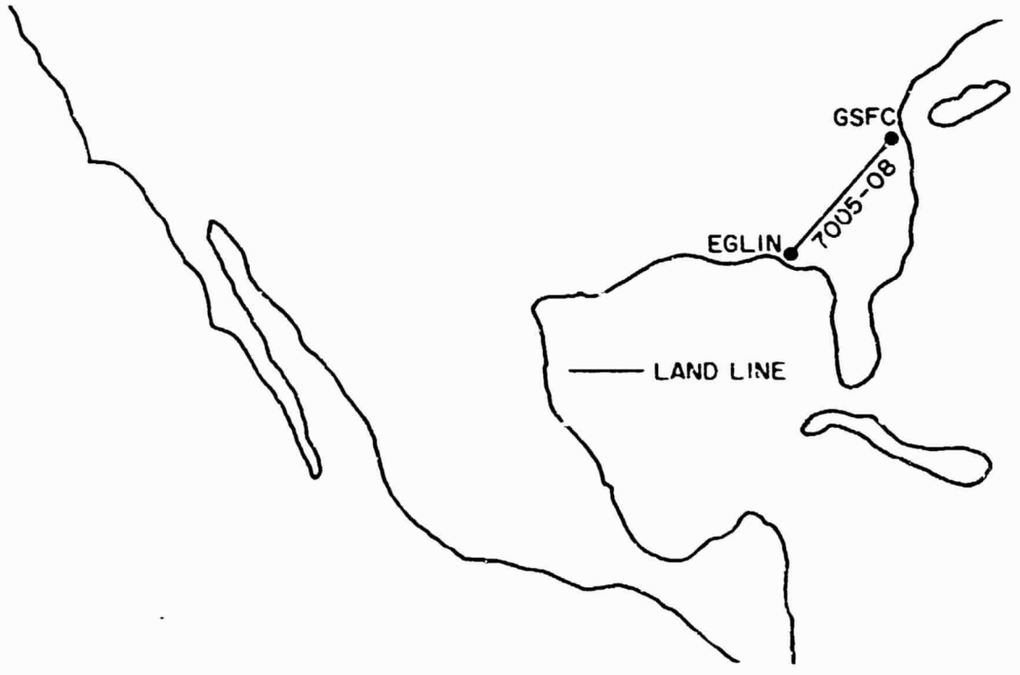
GEGL-08 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
B Line-cable-microwave	-	-	-	-	-	:16
P Power failure	-	-	:02	-	-	:02
TOTAL OUTAGE	0:00	0:00	:02	0:00	0:00	:18
SCHED OPER TIME	322	240	272	322	240	272
RELIABILITY (Percent)	100.0	100.0	99.9	100.0	100.0	99.9

Summary

The GEGL-08 circuit continued to perform well in March. Only two outages were observed. On March 6 a microwave failure occurred between Fort Walton and Pensacola, Florida, and was responsible for 16 minutes of outage time. On March 24 both paths were interrupted for 2 minutes because of a power failure at the site.

No graphical analysis is shown for GEGL-08 (see page 22).



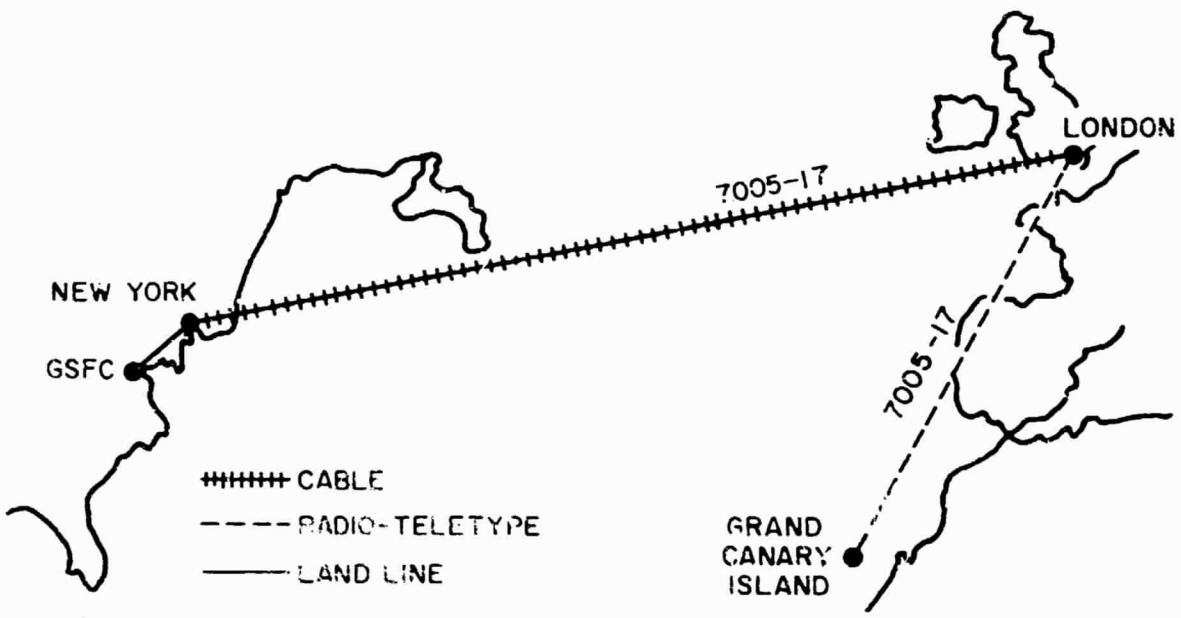
Outage Time and Reliability - Grand Canary Island

LCYI-17 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
A No trouble found	-	-	-	-	-	:20
B Line-cable-microwave	-	-	-	-	-	:15
C Operator error	-	-	:15	-	-	-
E Equipment failure	1:40	-	:48	:15	-	:20
G Poor propagation	:30	-	-	-	-	-
H Terminal station	-	-	-	:30	-	-
I Interference	1:40	-	-	1.40	-	-
P Power failure	:45	1:43	-	:45	1:43	-
TOTAL OUTAGE	4:35	1:43	1:03	3:10	1:43	:55
SCHED OPER TIME	232	192	168	232	192	168
RELIABILITY (Percent)	98.0	99.1	99.4	98.6	99.1	99.5

Summary

Reliability has been on an upward trend for LCYI-17 during the past three months, with a reduction in total operating hours. In March, a level of 99.4 percent was reached on the transmit path, and 99.5 percent on the receive path. All told, on both paths there were six outages in March, five of which ranged from 10 to 20 minutes in duration. The sixth and most prolonged outage interrupted the transmit path for a period of 48 minutes on March 31. A faulty regenerative repeater in the London office was responsible.



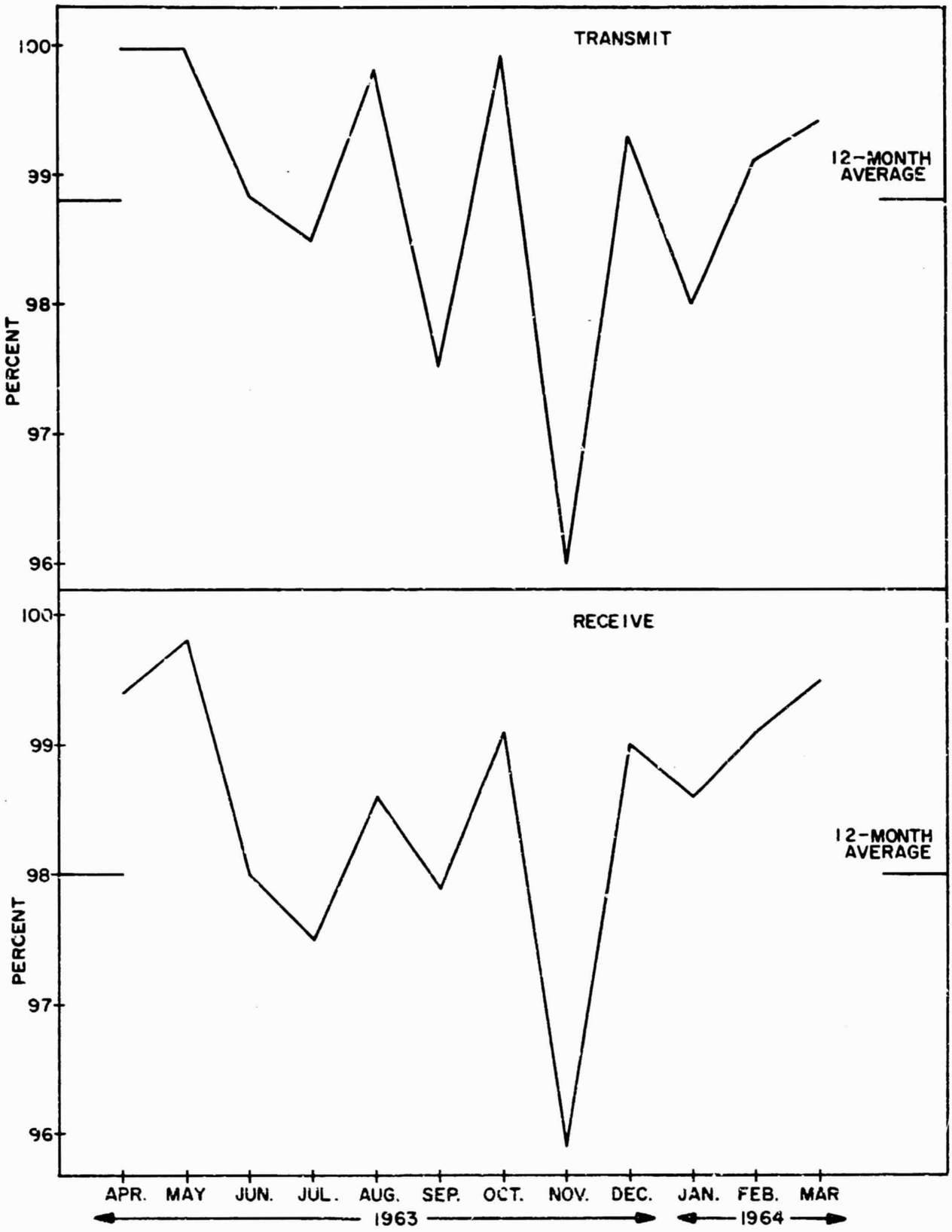


Figure 8. Circuit Reliability of LCYI-17

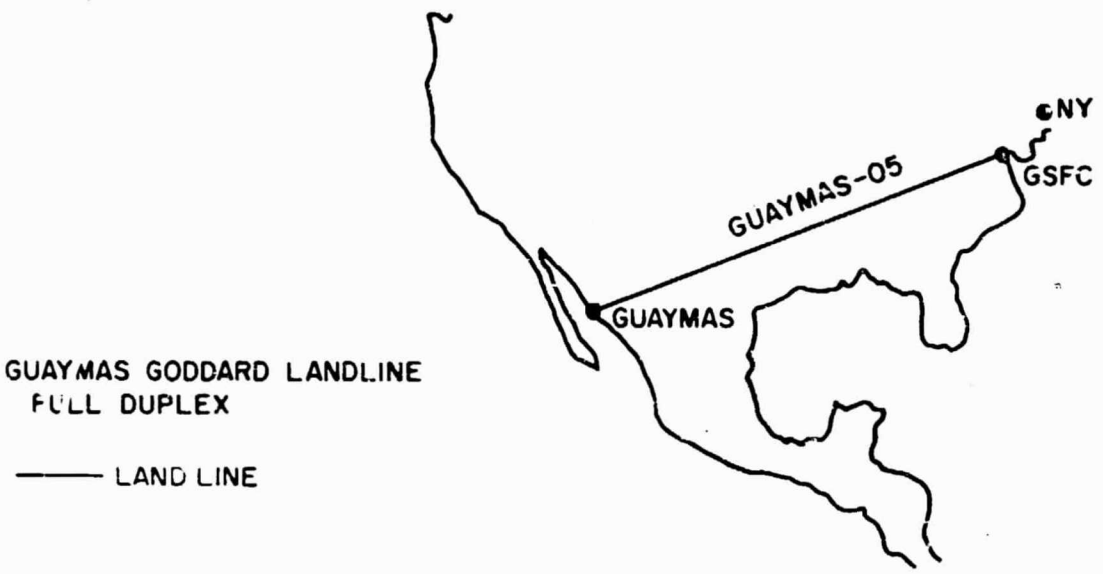
Outage Time and Reliability - Guaymas

GGYM-05 (Hours and Minutes)

TROUBLE CATEGORIES		TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
		JAN	FEB	MAR	JAN	FEB	MAR
A	No trouble found	-	:31	:02	-	-	-
B	Line-cable-microwave	1:26	1:19	1:23	:21	:43	:07
C	Operator error	8:55	-	-	8:55	-	-
E	Equipment failure	-	:52	-	-	:52	-
M	Maintenance	:35	-	:02	:35	-	-
	TOTAL OUTAGE	10:56	2:42	1:27	9:51	1:35	:07
	SCHED OPER TIME	744	696	676	744	696	676
	RELIABILITY (Percent)	98.7	99.6	99.8	98.7	99.8	99.9

Summary

The GGYM-05 circuit performed very reliably in March. Outages for the most part were of short duration, ranging from 1 to 9 minutes in length. An exception was a 57-minute interruption of the transmit path on March 24. Guaymas reported that a line-cable-microwave failure between Los Angeles and Tucson was responsible for the outage. In order to restore service, the common carrier patched around the faulty section at Tucson.



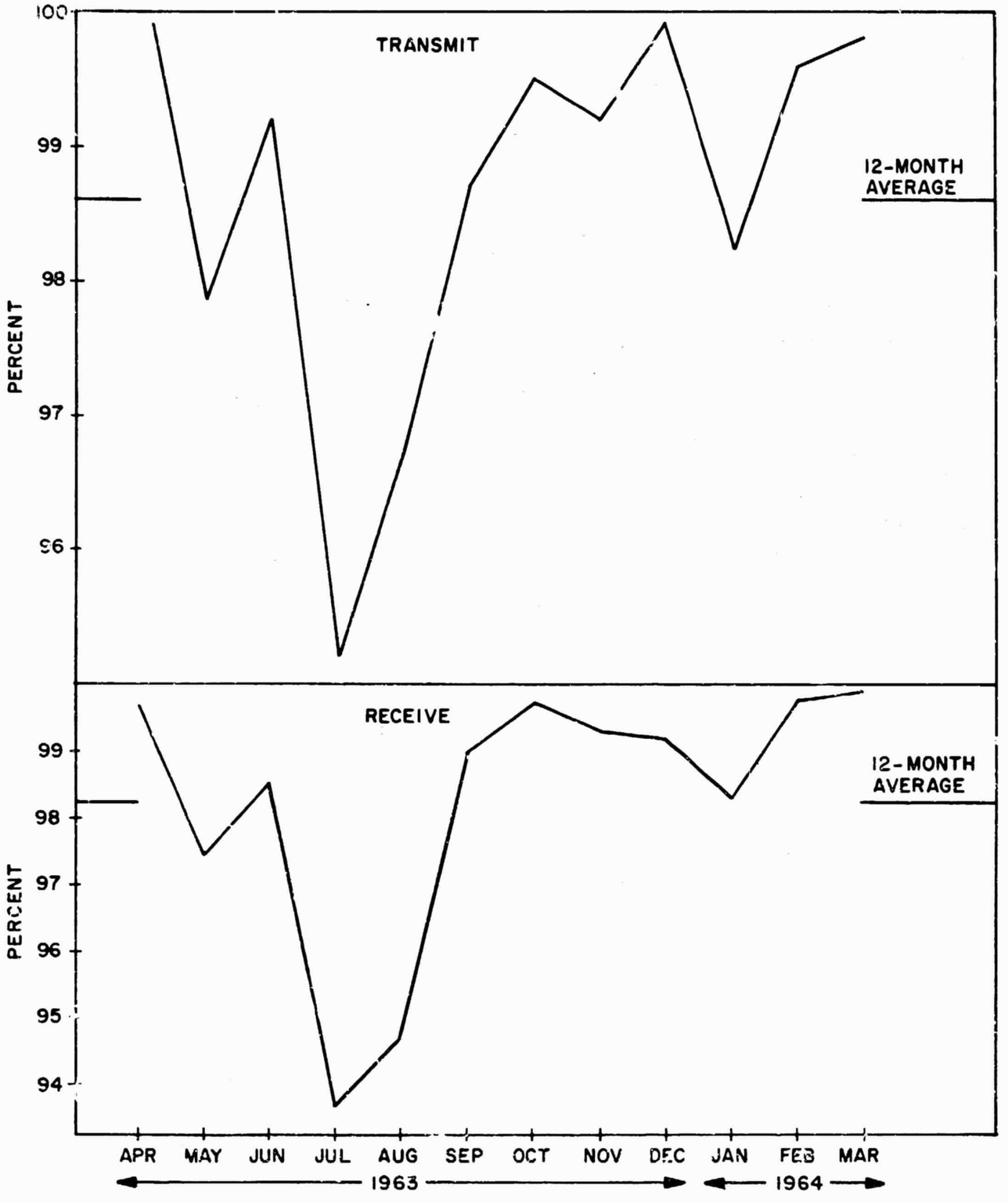


Figure 9. Circuit Reliability of GGYM-05

Outage Time and Reliability - Hawaii

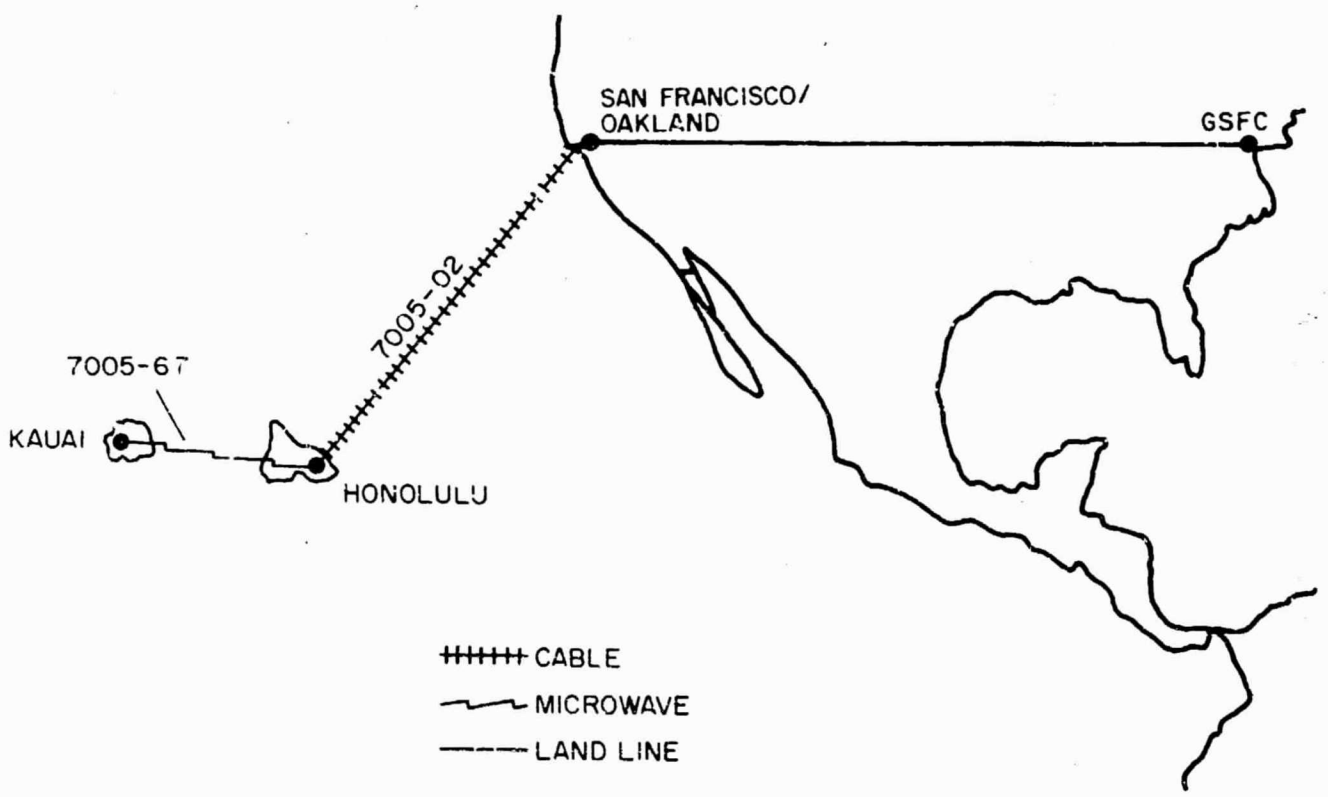
PHAW-02/67 (Hours and Minutes)

TROUBLE CATEGORIES		TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
		JAN	FEB	MAR	JAN	FEB	MAR
A	No trouble found	:40	-	:15	:40	-	-
B	Line-cable-microwave	:26	:20	2:00	:10	:20	2:00
E	Equipment failure	:30	-	2:04	:35	-	-
M	Maintenance	1:20	-	:31	1:20	-	:31
	TOTAL OUTAGE	2:56	:20	4:50	2:45	:20	2:31
	SCHED OPER TIME	368	372	326	368	372	326
	RELIABILITY (Percent)	99.2	99.9	98.5	99.3	99.9	99.2

Summary

The PHAW-02/67 circuit performed less reliably in March than in any other month since October 1963. The two most critical outages during the period occurred on March 14 and 30. On March 14, both paths went out of service for 1:35 hours because of a carrier failure at Oakland. On March 30, a faulty receiver at the Puukapele, Hawaii, microwave station caused 2:04 hours of interruption on the transmit path.

No graphical analysis is shown for HAW-02/67 (see page 22).



Outage Time and Reliability - Kano

LKNO-17 (Hours and Minutes)

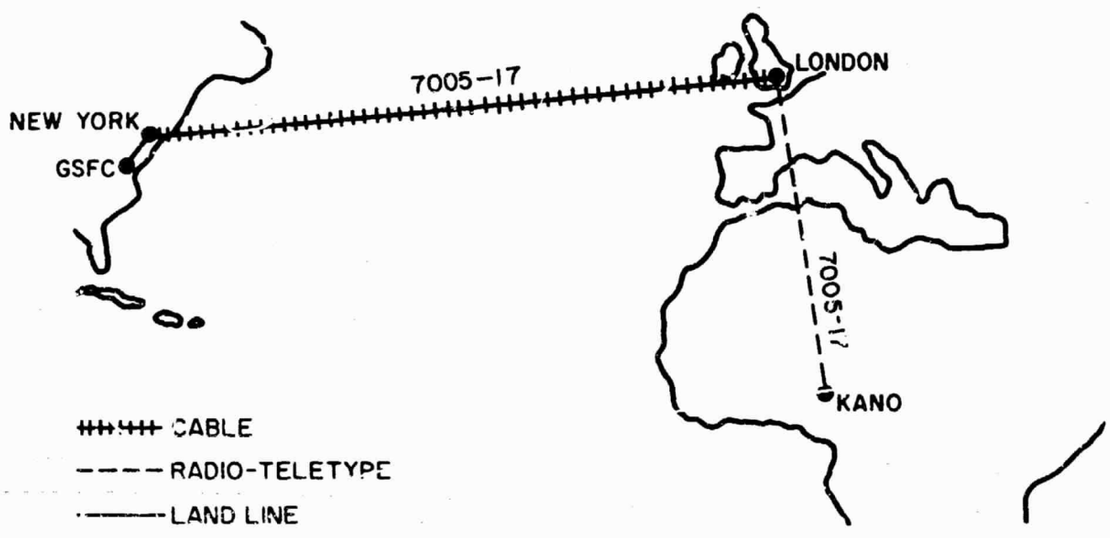
TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
A No trouble found	-	-	-	-	-	:10
B Line-cable-microwave	-	-	-	-	-	1:15
C Operator error	-	-	:15	-	-	-
E Equipment failure	4:54	-	-	4:33	-	:20
G Poor propagation	1:14	-	-	-	-	:55
TOTAL OUTAGE	6:08	0:00	:15	4:33	0:00	2:40
SCHED OPER TIME	184	160	170	184	160	170
RELIABILITY (Percent)	96.7	100.0	99.9	97.5	100.0	98.4

Summary

Although the LKNO-17 circuit did not achieve 100-percent reliability in March—which, incidentally, it did in February—it nevertheless performed relatively well. A 15-minute outage occurred on the transmit path on March 31, as a result of operator error: two transmitters were patched into the line simultaneously at GSFC. This was the only reported outage on the transmit path.

The receive path experienced significantly more frequent and longer total interruptions; however, it has not been determined why there was such a variance in total outage time between the two paths. Nearly 60 percent of the total lost time on the receive path was due to line-cable-microwave and equipment failures between the Bearley receiver site and the London Office: line-cable-microwave failures accounted for 45 minutes of outage on March 16th and 30 minutes on the 17th; equipment failures for 20 minutes on the 25th. The only other major outage on the receive path was a 55-minute interruption due to propagation failure on the 30th.

No graphical analysis is shown for LKNO-17 (see page 22).



Outage Time and Reliability - Texas

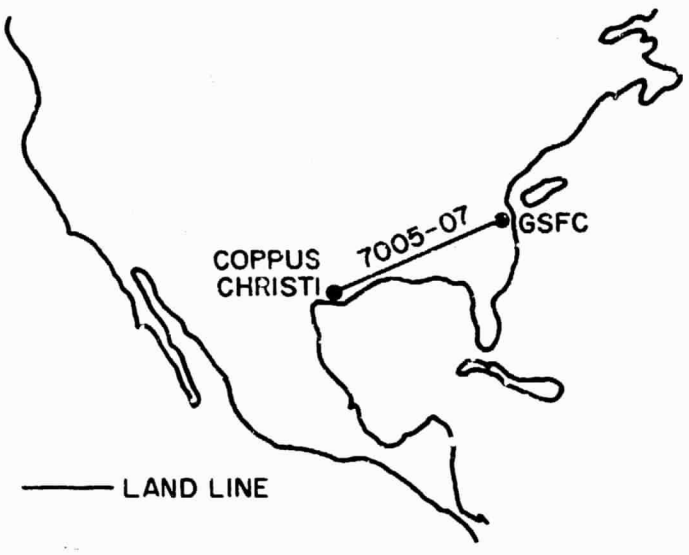
GTEX-07 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
B Line-cable-microwave	-	-	2:20	-	:14	2:20
TOTAL OUTAGE	0:00	0:00	2:20	0:00	:14	2:20
SCHED OPER TIME	276	190	198	276	190	198
RELIABILITY (Percent)	100.0	100.0	98.8	100.0	99.9	98.8

Summary

Analysis of the GTEX-07 circuit discloses that an abrupt decline in reliability occurred during March. Since reaching a low of 98.8 percent in December 1962, the circuit had performed above the 99 percent level until March. The March decline was almost entirely the consequence of a 2:10-hour interruption on March 10. At that time, the cable carrying the circuit near Corpus Christi was accidentally dug up and severed. An additional 10 minutes of outage occurred on March 27, as a consequence of line trouble between Washington and Dallas.

No graphical analysis is shown for GTEX-07 (see page 22).



Outage Time and Reliability - White Sands

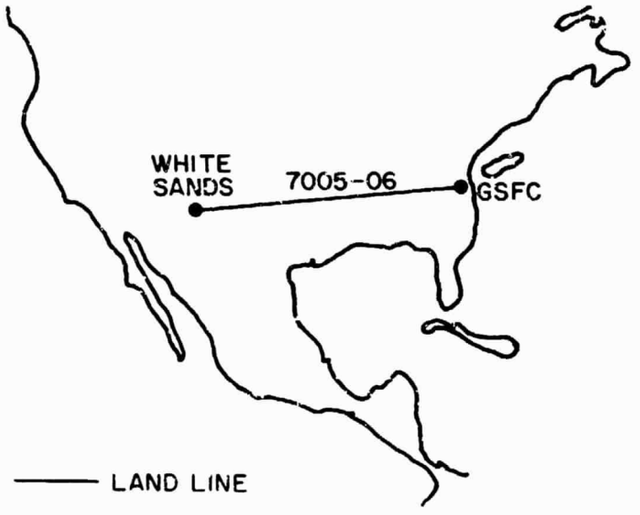
GWHS-06 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
B Line-cable-microwave	:37	-	-	:37	-	:10
E Equipment failure	:03	-	-	-	-	-
P Power failure	1:45	-	-	1:45	-	-
TOTAL OUTAGE	2:25	0:00	0:00	2:22	0:00	:10
SCHED OPER TIME	184	200	181	184	200	181
RELIABILITY (Percent)	98.7	100.0	100.0	98.7	100.0	99.9

Summary

The GWHS-06 circuit performed very well throughout March. Outages were limited to a single interruption. On March 8, a 10-minute line failure occurred on the receive path between White Sands and Washington.

No graphical analysis is shown for GWHS-06 (see page 22).



Group 2 Stations

Johannesburg RA-30
Johannesburg RA-54
Johannesburg Back-Up
Lima (NS-111)
Quito (NS-108)
Santiago (NS-109)
Woomera (RA-35) (See note below)

A complete listing of Group 2 teletype circuits and terminal stations is given in Table 3. The seven Group 2 station/circuits listed above have experienced considerable variation in their reliability characteristics over an extended period of time. All of these circuits have HF radio links over a large portion of their circuit path, making them more vulnerable to variations in performance. Because of the wide fluctuations in their reliabilities, these circuits have been subjected to a detailed analysis for the purpose of improving their overall performance. (Those Group 2 circuits which have shown a consistently high degree of reliability are not included in this analysis.) A direct comparison of reliabilities attained in March with those of the two previous months is presented in the tables which follow.

NOTE: The Woomera (RA-35) circuit, which had been all-cable since December 13, 1964, was again made an HF link between Honolulu and Sydney on March 4, 1964.

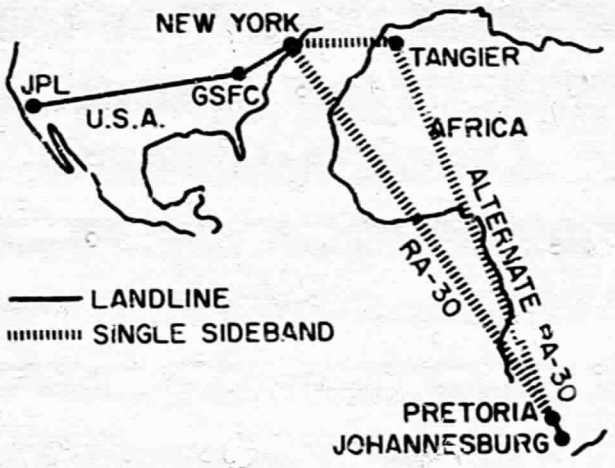
Outage Time and Reliability - Johannesburg

RA-30 (Hours and Minutes)

TROUBLE CATEGORIES		TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
		JAN	FEB	MAR	JAN	FEB	MAR
A	No trouble found	-	:55	:15	-	2:25	:15
B	Line-cable-microwave	4:55	1:55	:10	13:40	5:35	:10
C	Operator error	:25	-	-	:25	-	-
D	Equipment adjustment	-	1:00	:15	-	1:00	:15
E	Equipment failure	3:50	2:35	4:50	4:25	5:35	4:55
F	Wire defect	-	:40	-	-	-	-
G	Poor propagation	52:00	44:25	52:00	52:00	43:55	62:10
I	Interference	-	-	-	-	:20	-
K	Frequency change	2:00	:40	4:10	2:00	:20	4:10
M	Maintenance	-	-	-	-	-	:20
P	Power failure	2:05	2:30	6:00	2:05	2:30	6:00
	TOTAL OUTAGE	65:15	54:40	77:40	74:35	61:40	78:15
	SCHED OPER TIME	744	696	744	744	696	744
	RELIABILITY (Percent)	91.2	92.1	89.6	90.0	91.1	89.5

Summary

The RA-30 circuit was operated exclusively over the alternate path (through Tangiers) during the entire month of March. Transmit path reliability using this route declined in March, as shown in Figure 10, by 2.5 percentage points below the 92.1 percent reliability index of February. The increase in total path outages averaged 37 minutes per day, with poor propagation accounting for 30.7 percent of the increase in outage time. Power-failure lost time increased from 2:30 hours in February to 6:00 hours in March. Equipment-failure outage time also increased, going from 2:35



hours in February to 4: 50 hours in March. Frequency-change outage time, which amounted to only 40 minutes in February, increased to 4: 10 hours in March. The remaining trouble categories had little or no outages in March.

Receive path reliability in March declined 1. 6 percentage points, below the index for February (91. 1 percent), to 89. 5 percent. Inasmuch as the outage time for each trouble category on the receive path closely paralleled that on the transmit path, as may be seen in the table above, no further discussion of receive path reliability is made here.

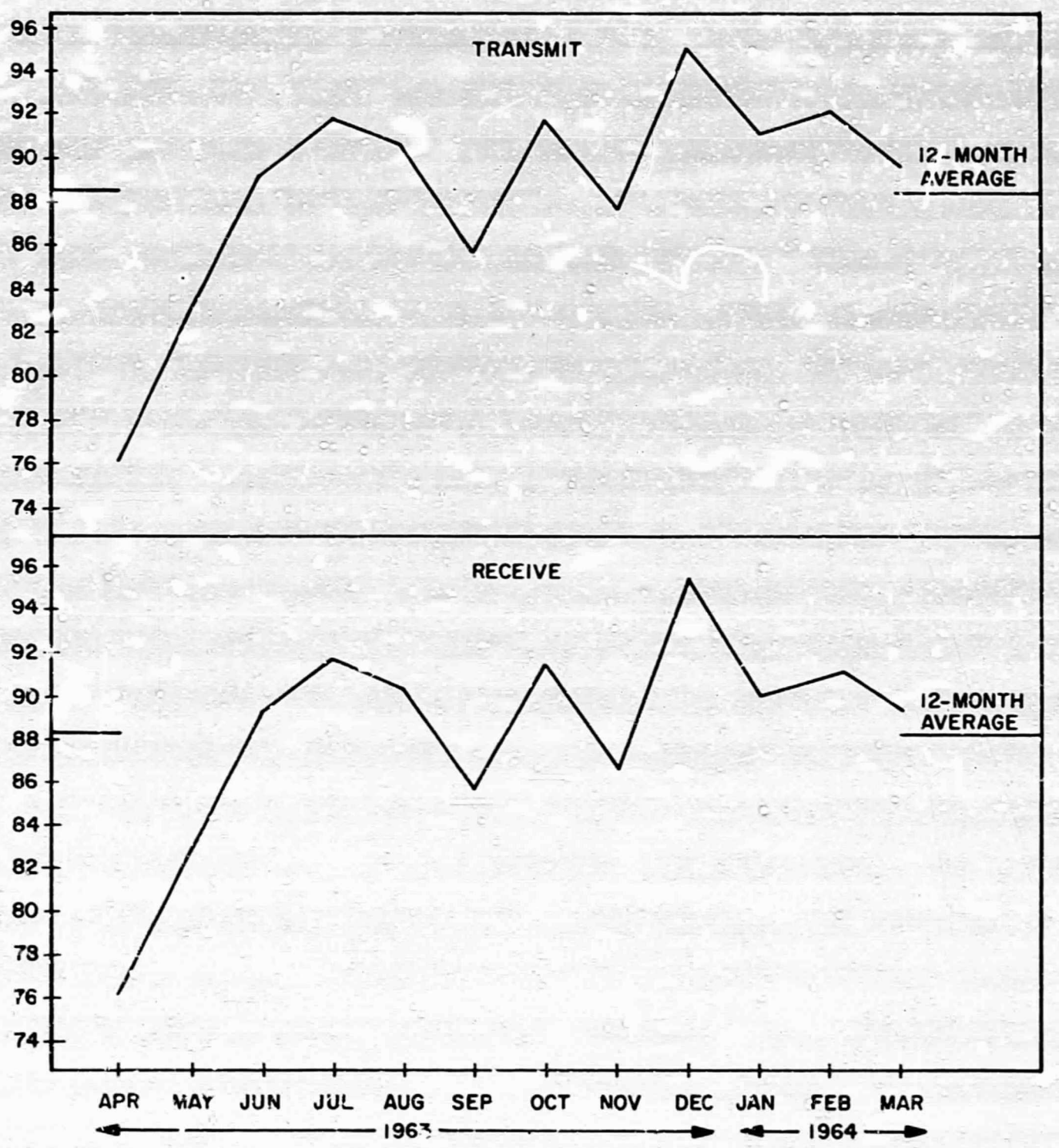


Figure 10. Circuit Reliability of RA-30

Outage Time and Reliability - Johannesburg

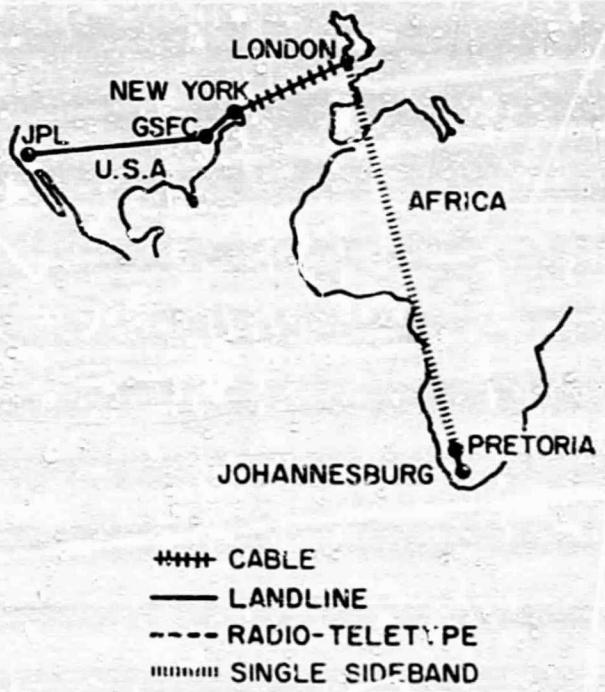
RA-54 (Hours and Minutes)

TROUBLE CATEGORIES		TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
		JAN	FEB	MAR	JAN	FEB	MAR
A	No trouble found	:10	2:50	3:20	:10	2:00	2:15
B	Line-cable-microwave	6:05	4:20	8:40	8:00	6:55	2:00
C	Operator error	-	-	-	-	-	:30
D	Equipment adjustment	-	:20	-	-	:20	-
E	Equipment failure	5:15	18:10	16:25	8:40	16:25	12:30
G	Poor propagation	85:55	57:25	65:40	85:55	57:25	65:35
I	Interference	:15	-	-	:15	-	-
K	Frequency change	1:15	-	:15	1:15	-	:15
M	Maintenance	-	-	-	-	-	:15
P	Power failure	1:45	1:40	6:40	1:45	1:40	6:40
	TOTAL OUTAGE	100:40	84:45	101:00	106:00	84:45	90:00
	SCHED OPER TIME	744	696	744	744	696	744
	RELIABILITY (Percent)	86.5	87.8	86.4	85.8	87.8	87.9

Summary

The RA-54 transmit path reliability index decreased from 87.8 percent in February to 86.4 percent in March, as indicated in Figure 11. This was the third consecutive month and the fifth out of the past seven months in which the transmit path reliability has been below the average for 12 months, which was 90.4 percent. Although the poor propagation category had a substantial improvement in February, the March outages showed an average increase of 29 minutes per day for a total of 65:40 hours in propagation outage for the month. The equipment failure category was the second largest in outage time in March with a total of 16:25 hours. This category had an average daily decrease of five minutes in lost time per day and is the only category which decreased during the month. The line-cable-microwave trouble category doubled its February outage, for a total of 8:40 hours in March, while power failures increased by 5 hours. There were no significant outages in the remaining trouble categories.

The receive path reliability index increased by only 0.1 percentage point in March. The poor propagation category had a small average increase of four minutes per day, and totalled 65:35 hours of outage in March. The equipment failure category decreased in outage time from 16:25 hours in February, to 12:30 hours in March, or an average of nine minutes per day. Line-cable-microwave lost time decreased by nearly five hours to a total of only 2:00 hours in March. The power failure category had a 5-hour increase in lost time, while the remaining trouble categories had little or no significant outages.



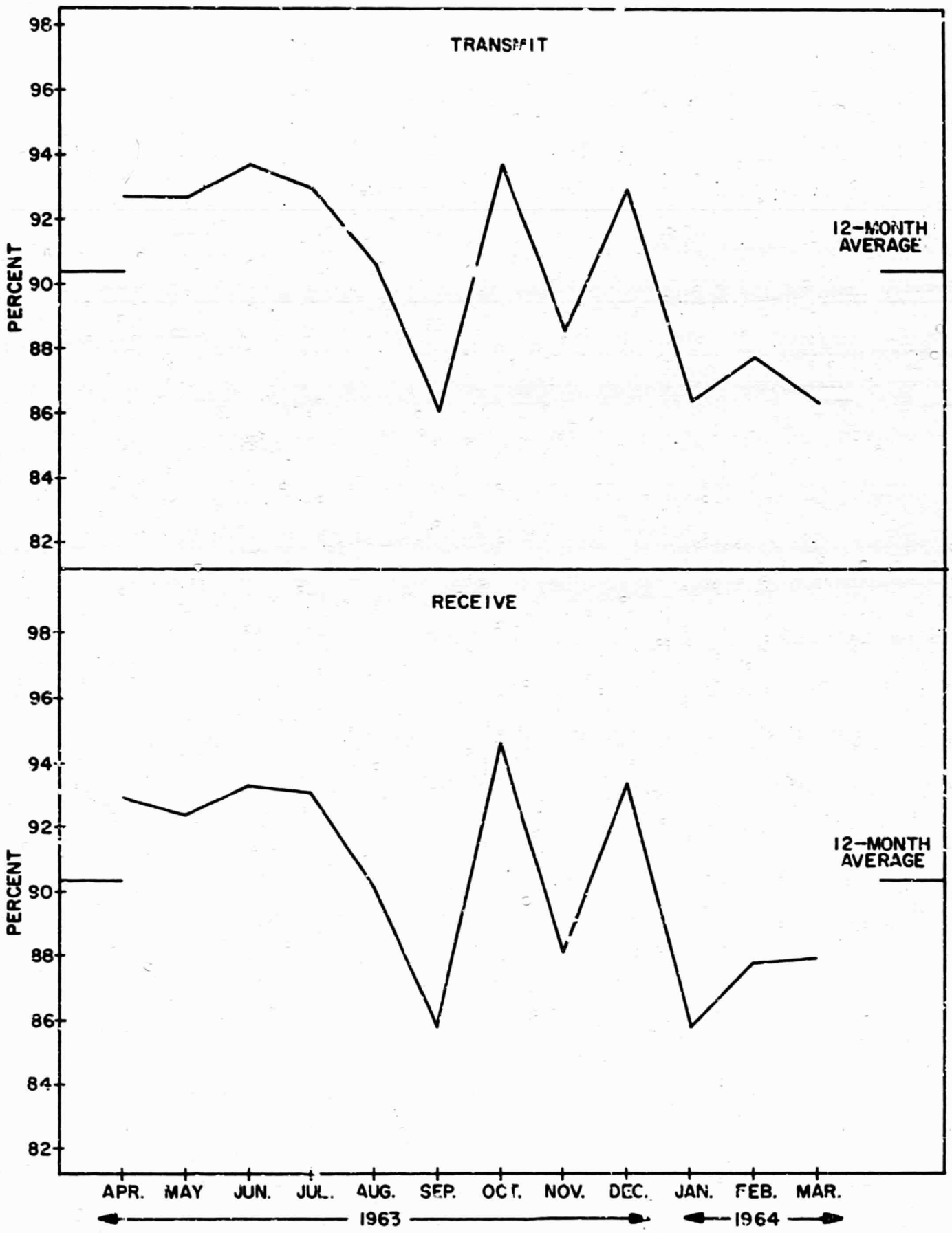


Figure 11. Circuit Reliability of RA 54

Outage Time and Reliability - NASA Johannesburg/Adelaide (Back-Up)

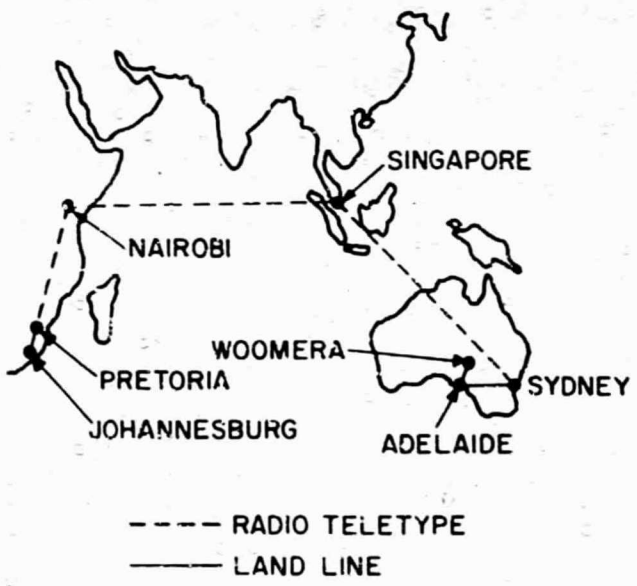
(Hours and Minutes)

TROUBLE CATEGORIES		TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
		JAN	FEB	MAR	JAN	FEB	MAR
A	No trouble found	2:05	6:20	4:15	2:05	5:45	4:15
B	Line-cable-microwave	6:40	5:50	11:40	1:45	6:50	13:30
C	Operator error	1:00	1:45	-	1:25	1:45	-
E	Equipment failure	7:00	6:50	6:15	9:15	6:50	6:15
F	Wire defect	-	-	-	-	1:20	-
G	Poor propagation	68:45	80:15	152:40	69:10	79:50	152:40
I	Interference	:40	-	-	:40	-	-
K	Frequency change	19:10	26:05	20:05	20:10	25:25	20:20
M	Maintenance	-	:15	-	-	:15	-
P	Power failure	4:50	3:30	1:35	4:50	3:30	1:35
	TOTAL OUTAGE	110:10	130:50	196:30	109:20	131:30	198:35
	SCHED OPER TIME	744	696	744	744	696	744
	RELIABILITY (Percent)	85.2	81.2	73.6	85.3	81.1	73.3

Summary

The NASA Johannesburg/Adelaide "Back-Up" circuit (for the RA-30 circuit) had a total outage time of 395:05 hours in March, compared to only 155:55 hours of outage logged on the RA-30 circuit. However, since most of the outage periods for the two circuits did not coincide, the Back-Up circuit was useful for approximately 60 percent of the time that the RA-30 circuit was out.

The reliability of both the transmit and receive paths of the Back-Up circuit has declined during the past three months, as indicated in Figure 12. The transmit path reliability index declined from 85.2 percent in January, to 81.2 percent in February, to 73.6 percent in March. The decrease in March was due primarily to the sharp rise in propagation outage time, which jumped from 80:15 hours in February, to 152:40 hours in March, and represented 77.7 percent of total path outage time for the month. Frequency-change outage time decreased from 26:05 hours in February, to 20:05 hours in March, but line-cable-microwave outage time doubled, increasing from 5:50 hours in February to 11:40 hours in March. Equipment-failure lost time, which totalled 6:50 hours in February, decreased slightly, declining to 6:15 hours in March. Lost time in the no-trouble-found category, which amounted to 6:20 hours in February, decreased to 4:15 hours in March.



The receive path reliability indices have closely paralleled those of the transmit path over the past three months, including March. The outages for each of the trouble categories on the receive path being essentially the same as those on the transmit path during the period, a detailed analysis of the receive path is not made for this report.

As for overall circuit performance in the near future, there is little probability that propagation outage time on this circuit will significantly decrease, because of the three lengthly radio paths involved, and the unfavorable long-term HF radio propagation forecasts of the National Bureau of Standards.

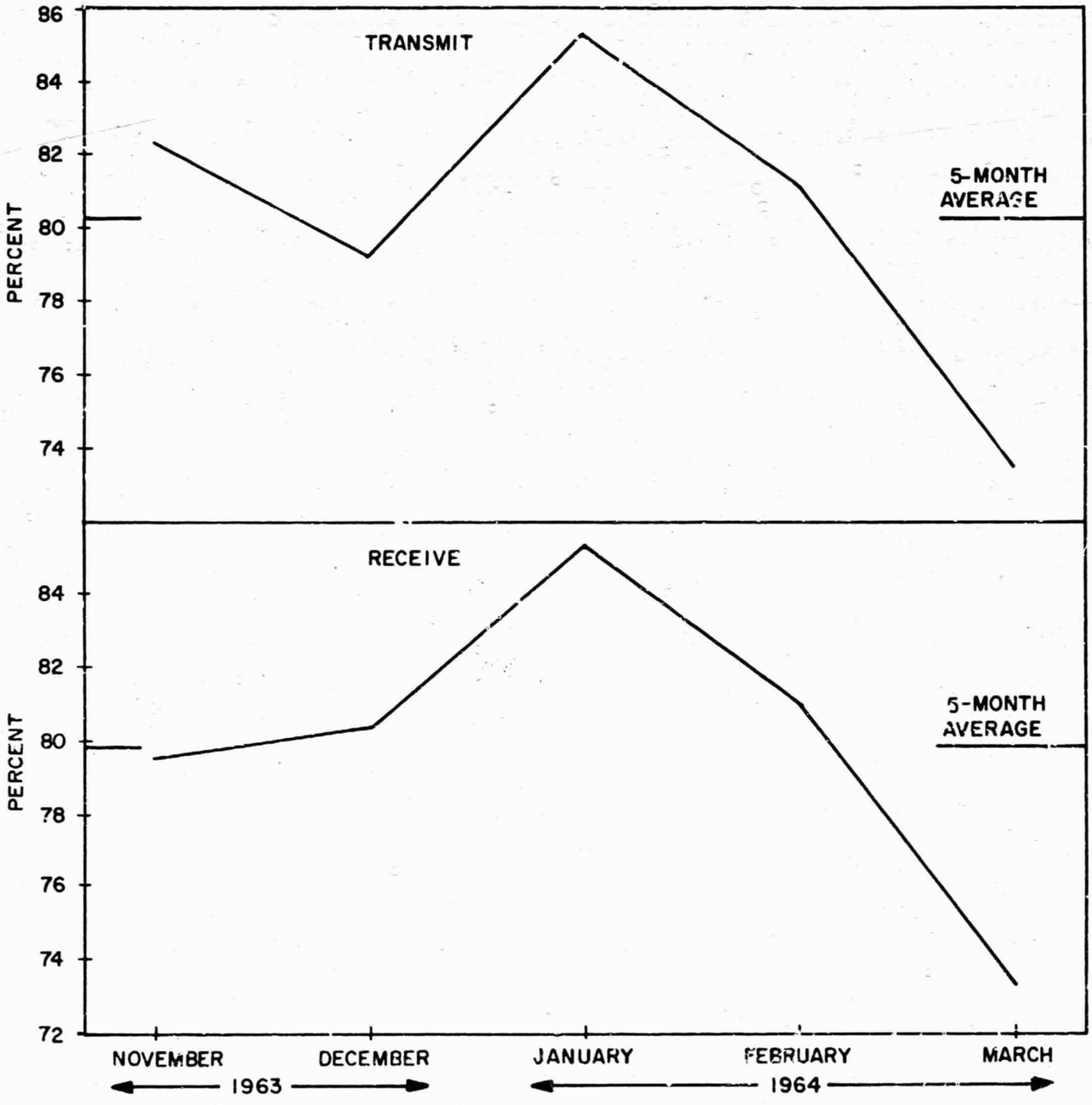


Figure 12. Circuit Reliability of NASA Johannesburg/Adelaide "Back-Up" Circuit

Outage Time and Reliability - Lima

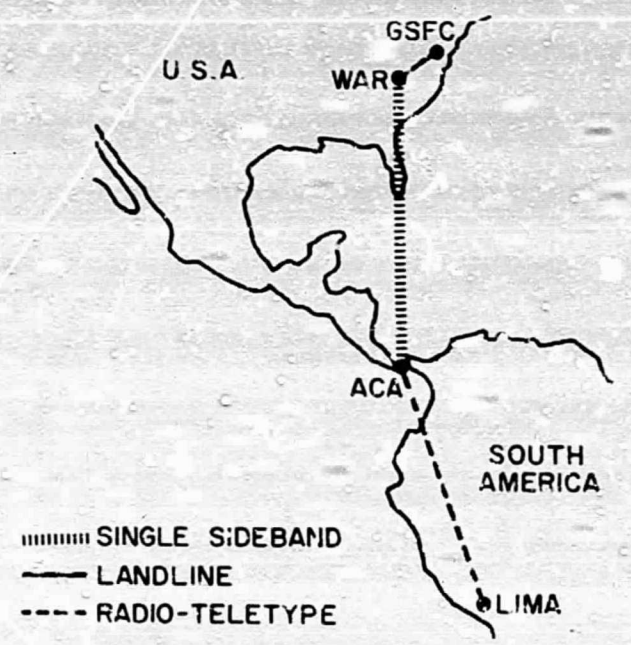
NS-111 (Hours and Minutes)

TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
A No trouble found	1:10	1:30	3:00	:05	:35	:45
B Line-cable-microwave	-	:20	3:00	-	:20	3:05
C Operator error	5:35	:45	10:05	4:55	:10	2:30
D Equipment adjustment	:20	:20	-	:40	:15	-
E Equipment failure	14:25	7:15	2:05	4:10	1:25	2:40
F Wire defect	:35	-	-	:35	-	-
G Poor propagation	34:10	48:45	22:35	31:50	38:25	35:00
I Interference	-	1:50	:25	1:30	1:40	1:05
K Frequency change	23:05	20:30	15:00	13:50	13:55	12:10
P Power failure	1:25	1:25	3:20	1:50	2:10	2:15
TOTAL OUTAGE	80:45	82:40	59:30	59:25	58:55	59:30
SCHED OPER TIME	744	696	744	744	696	744
RELIABILITY (Percent)	89.1	88.1	92.0	92.0	91.5	92.0

Summary

Reversing a 3-month downward trend, as shown in Figure 13, the reliability index of the NS-111 transmit path increased by 3.9 percentage points to 92.0 percent in March. The principal factor contributing to this improvement was a reduction of 26:10 hours in propagation outage, or an average decrease of 57 minutes per day. Outages in the frequency-change category continued to decline as in the previous two months, dropping from 23:05 hours in January, to 20:30 hours in February, to 15:00 hours in March. Equipment-failure outages also declined over the same period, dropping from 14:25 hours in January, to 7:15 hours in February, to 2:05 hours in March. The operator-error category had a large increase in outage time, jumping from 45 minutes in February to 10:05 hours in March. Three other trouble categories—the no-trouble-found, line-cable-microwave, and power-failure categories—had a combined increase in lost time of 6:05 hours in March. The other categories had negligible outages on the transmit path.

The receive path reliability index, which had decreased from 92.0 percent in January to 91.5 percent in February, rose again to 92.0 percent in March. The poor-propagation and frequency-change categories had a combined decrease of 5:10 hours in outage time in March. This was offset for the most part by small to moderate increases in the line-cable-microwave, operator-error, equipment-failure, and power-failure categories. The remaining categories had little or no outages charged to them.



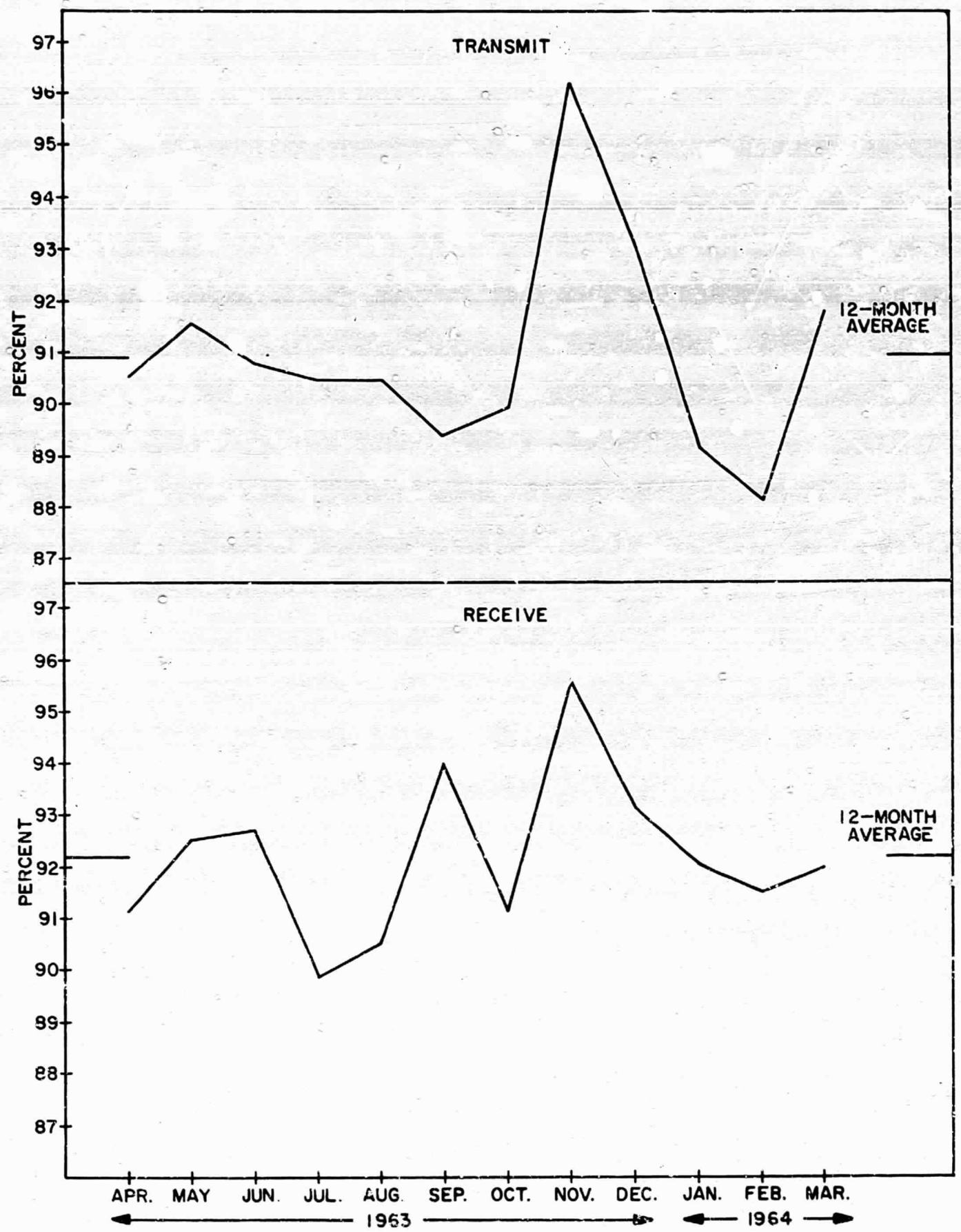


Figure 13. Circuit Reliability of NS-111

Outage Time and Reliability - Quito

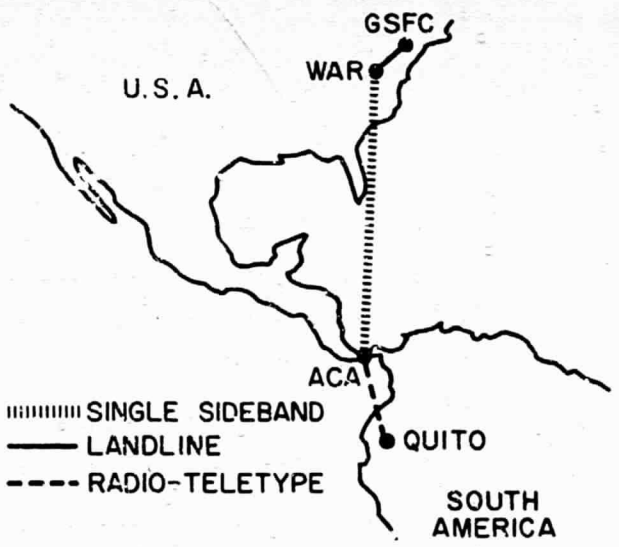
NS-108 (Hours and Minutes)

TROUBLE CATEGORIES		TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
		JAN	FEB	MAR	JAN	FEB	MAR
A	No trouble found	1:45	:50	1:00	-	:10	:25
B	Line-cable-microwave	-	-	3:00	-	:20	3:15
C	Operator error	1:20	1:10	-	:25	-	:20
D	Equipment adjustment	1:40	-	:15	:55	:55	-
E	Equipment failure	25:50	5:25	6:10	2:10	6:20	7:10
F	Wire defect	-	-	:40	-	-	-
G	Poor propagation	70:00	53:30	66:45	47:30	39:25	47:50
I	Interference	:05	:30	-	:05	1:45	-
K	Frequency change	24:10	8:00	16:50	3:20	7:35	9:45
M	Maintenance	:30	1:05	-	:30	1:10	-
P	Power failure	:50	:40	3:05	:50	:30	2:35
	TOTAL OUTAGE	126:10	71:10	97:45	55:45	58:10	71:20
	SCHED OPER TIME	744	696	744	744	696	744
	RELIABILITY (Percent)	83.0	89.8	86.9	92.5	91.6	90.4

Summary

The NS-108 transmit path reliability index declined by 2.9 percentage points to 86.9 percent during March, as shown graphically in Figure 14. Contributing in large measure to this decrease in reliability was poor propagation which accounted for 13:15 hours of increase in lost time with a total of 66:45 hours in March. A further crucial factor was frequency changes. Outage time, due to this trouble category more than doubled in March bringing the total to 16:50 hours for the month. The poor-propagation and frequency-change categories accounted for 85.5 percent of total path outages. Equipment failures, caused 5:25 hours of lost time in February, and accounted for 6:10 hours of outage in March. The power failure category had 3:05 hours of outage, the line-cable-microwave category had 3:00 hours, and the no-trouble-found category had 1:00 hour.

The receive path reliability index declined by 1.2 percentage points to 90.4 percent in March. Poor propagation continued to be the major cause of lost time, accounting for 47:50 hours, or an increase of 8:25 hours over February. The frequency-change category was second in amount of outage, increasing from 7:35 hours in February to 9:45 hours in March. Poor-propagation and frequency-change outages, combined, accounted for 80.7 percent of the total path outage time. Equipment-failure outages increased from 6:20 hours in February to 7:10 hours in March. Outage time in the line-cable-microwave category, which had only 20



minutes of lost time in February, increased to 3: 15 hours in March. Outages due to power failures likewise increased, jumping from 30 minutes in February to 2: 35 hours in March. The remaining categories had a negligible amount of outage.

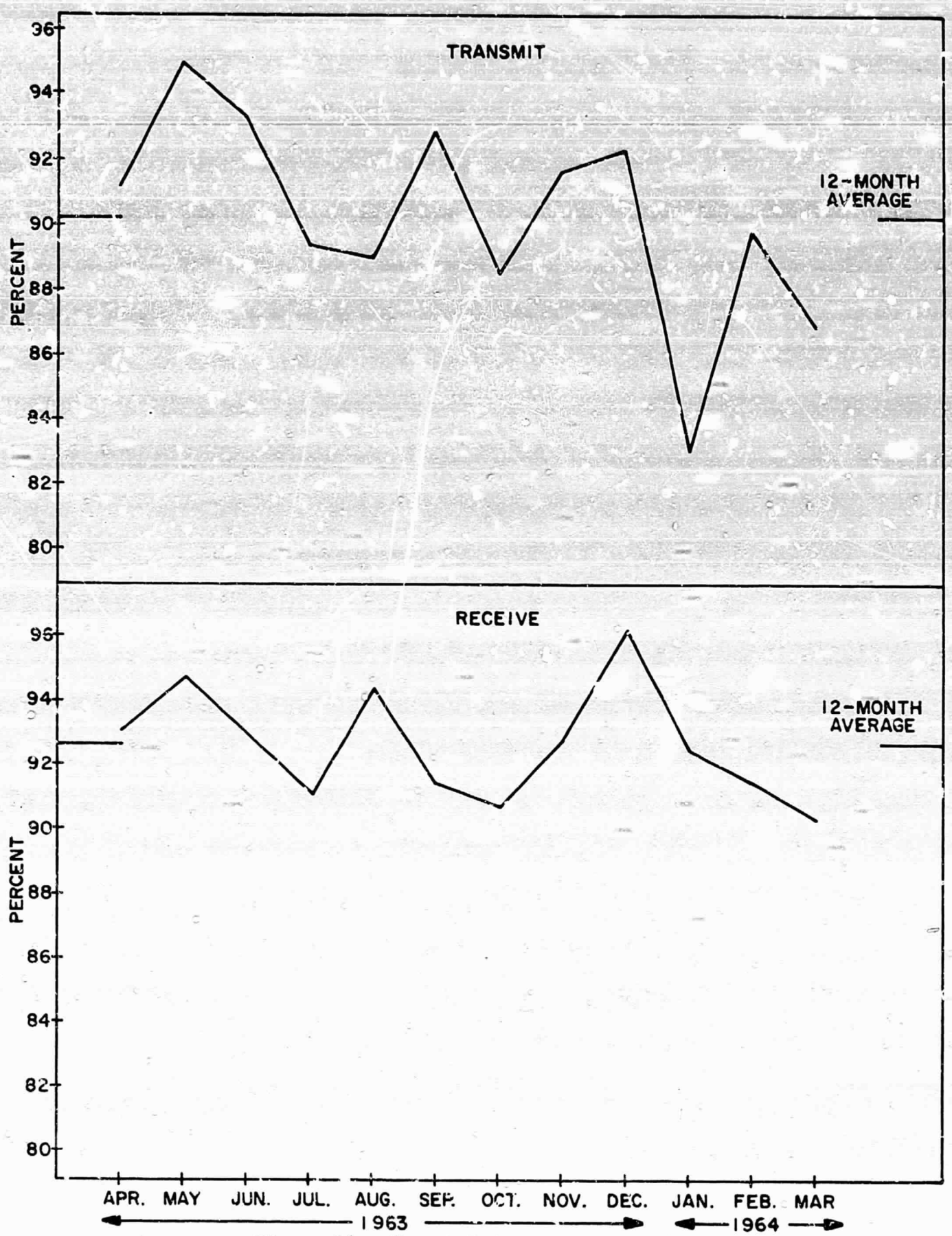


Figure 14. Circuit Reliability of NS-108

Outage Time and Reliability - Santiago

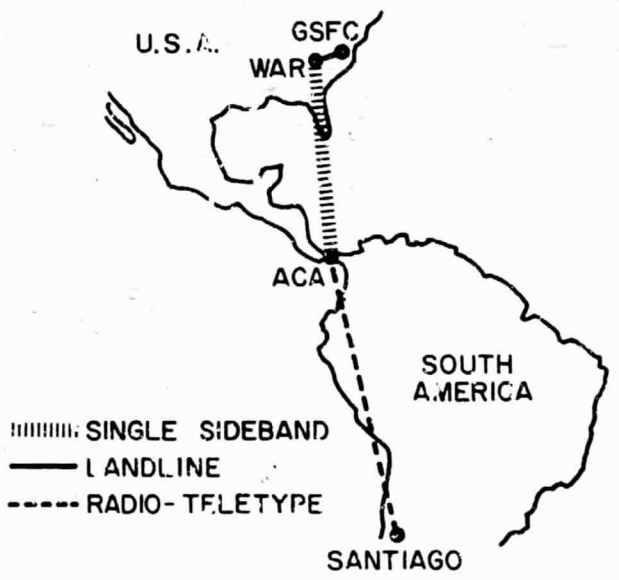
NS-109 (Hours and Minutes)

TROUBLE CATEGORIES		TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
		JAN	FEB	MAR	JAN	FEB	MAR
A	No trouble found	2:40	1:10	3:50	2:00	:40	:10
B	Line-cable-microwave	1:45	-	3:00	:15	:10	3:00
C	Operator error	-	:20	:45	-	:30	-
D	Equipment adjustment	:45	:20	:25	2:20	:50	-
E	Equipment failure	25:45	9:20	7:55	10:45	23:45	9:00
F	Wire defect	1:00	-	:55	-	-	-
G	Poor propagation	66:25	86:35	48:45	51:45	54:10	40:45
I	Interference	23:25	1:55	8:40	6:45	:55	:55
K	Frequency change	52:55	27:05	21:35	12:15	15:30	17:25
M	Maintenance	-	-	2:00	-	-	-
P	Power failure	:10	1:05	2:50	:55	1:05	2:40
	TOTAL OUTAGE	174:50	127:50	100:40	87:00	97:35	73:55
	SCHED OPER TIME	744	696	744	744	696	744
	RELIABILITY (Percent)	76.5	81.6	86.5	88.3	86.0	90.1

Summary

The NS-109 transmit path reliability index increased by 4.9 percentage points, as shown in Figure 15, to 86.5 percent in March. The major cause of this increased reliability was a reduction in propagation outage from a daily average of 2:59 hours in February to 1:34 hours per day in March—a reduction of 47.3 percent. Frequency-change lost time declined from a monthly total of 27:05 hours in February to 21:35 hours in March. Equipment failures, which caused 9:20 hours of outage in February, were responsible for 7:55 hours of lost time in March. Outage time due to interference, the only category which had a sizable increase in outage time in March, increased from 1:55 hours in February to 8:40 hours. The no-trouble-found and line-cable-microwave categories had a combined increase of 5:40 hours in outage time in March. Maintenance and power-failure outage times, together, increased 3:45 hours. The operator-error, equipment-adjustment, and wiring-defect categories each had less than one hour of lost time.

The receive path reliability index increased 4.1 percentage points in March to 90.1 percent. This increase was due principally to a decrease in propagation and equipment-failure outage. These two categories accounted for a reduction of 28:10 hours in lost time. The poor-propagation category, alone, had a daily



average reduction in lost time of 29.6 percent, lost time dropping from an average of 1:51 hours per day in February to 1:18 hours per day in March. The equipment-failure category had a daily average reduction in outage of 64.6 percent, average lost time decreasing from 49 minutes per day in February to 17 minutes in March or 32 minutes per day. Frequency-change outage time increased from 15:30 hours in February to 17:25 hours in March--an average of nearly two minutes per day. The line-cable-microwave and power-failure categories had substantial increases. The other trouble categories had little if any outage time during the month.

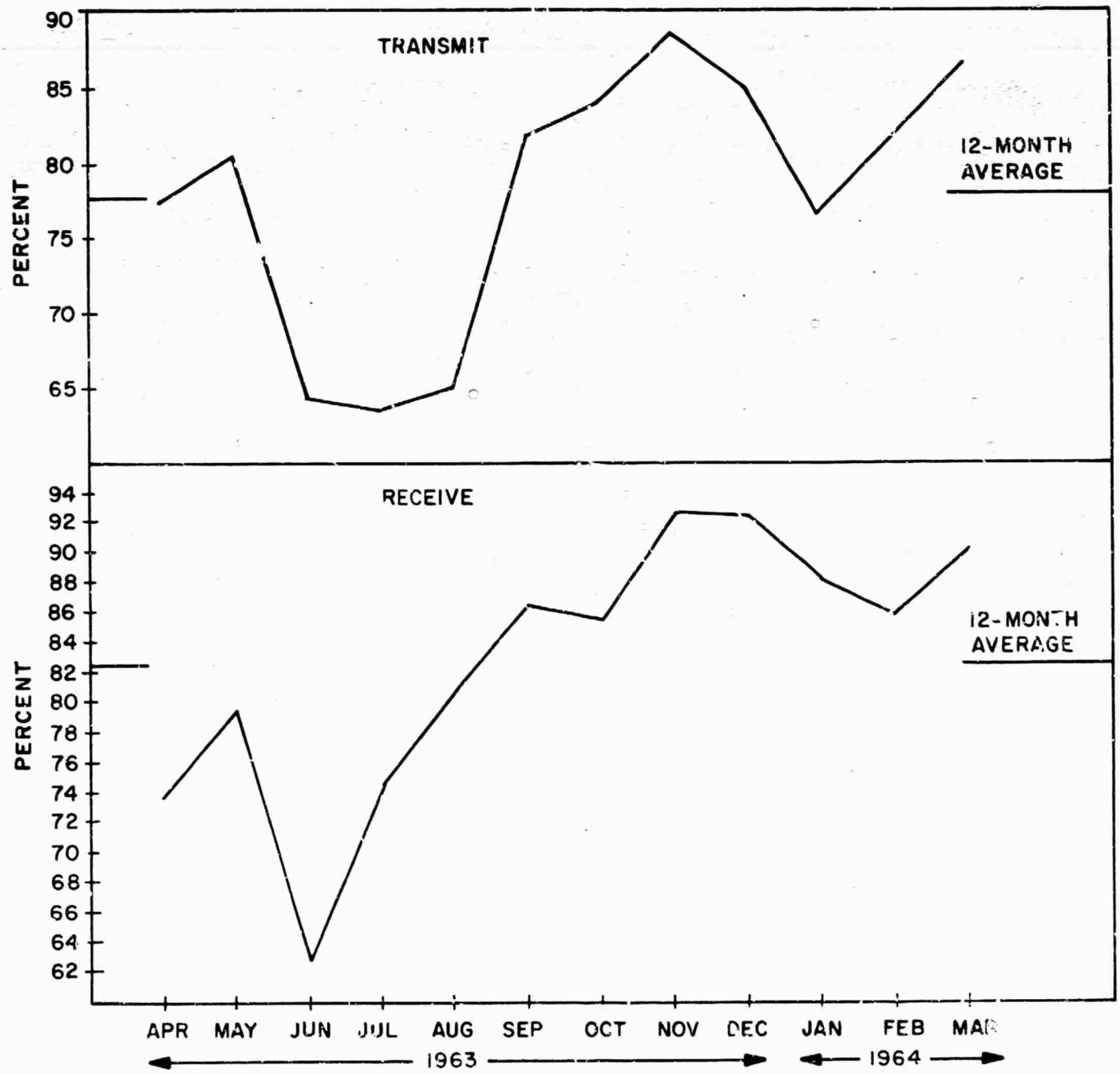


Figure 15. Circuit Reliability of NS-109

Outage Time and Reliability - Woomera

RA-35 (Hours and Minutes)

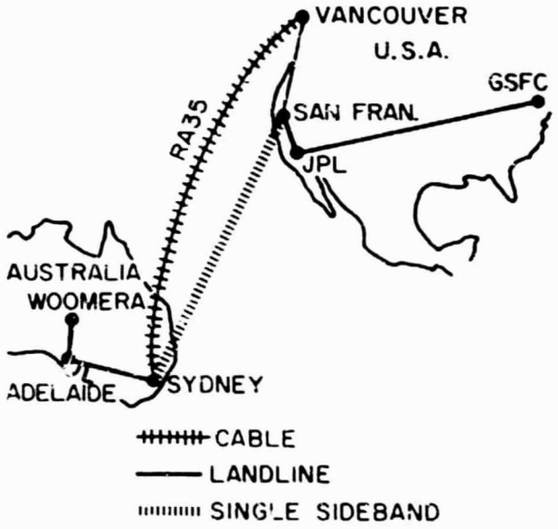
TROUBLE CATEGORIES	TRANSMIT (from GSFC)			RECEIVE (at GSFC)		
	JAN	FEB	MAR	JAN	FEB	MAR
A No trouble found	:25	1:45	4:30	:05	1:45	4:20
B Line-cable-microwave	2:15	9:15	24:40	2:35	6:40	24:00
C Operator error	1:20	:25	-	1:20	:25	-
E Equipment failure	2:30	4:40	12:35	2:45	2:35	21:10
G Poor propagation	-	-	11:00	-	-	10:20
K Frequency change	-	-	:35	-	-	:35
P Power failure	1:15	2:45	:45	1:15	2:45	:45
TOTAL OUTAGE	7:45	18:50	54:05	8:00	14:10	61:10
SCHED OPER TIME	744	696	744	744	696	744
RELIABILITY (Percent)	99.0	97.3	92.7	98.9	98.0	91.8

Summary

The RA-35 circuit was changed from a combination of cable and HF Radio to all-cable, via the newly installed Compac cable, on December 13, 1963. However, the Compac cable developed various troubles necessitating a return to the HF radio system on a periodic basis into Australia during the month of March. This included the use of the HF radio circuit during the cable failure resulting from the Alaskan earthquake on March 27 and 28.

Overall circuit reliability, taking into account changes made, increased sharply in January to 99.0 percent for the transmit path and 98.9 percent for the receive path. However, each path has since declined continuously in reliability, reaching an abnormally low index in March of 92.7 percent for the transmit path and 91.8 percent for the receive path, as shown graphically in Figure 16.

The major outages on the transmit path were due to line-cable-microwave failures, which accounted for 55.6 percent of the total path outage time in March. This amounted to 24:40 hours of outage, compared with 9:15 hours in February, and 2:15 hours in January. Equipment failures accounted for 23.3 percent of total path outages, or 12:35 hours of lost time in March, compared with 4:40 hours in February and 2:30 hours in January. The poor propagation category had 20.3 percent of the path outage time in March, or 11:00 hours; by contrast, there were no outages in this category in either January or February. The no-trouble-found category accounted for 8.3 percent of total path outages, or 4:30 hours in March, compared with 1:45 hours in February and 25 minutes in January. The two other main trouble categories—frequency change and power failure—had a combined outage of 1:20 hours in March.



The receive path outage time was very nearly the same as that on the transmit path for each of the trouble categories except equipment failure. This category accounted for 34.6 percent of the total path outage time, or 21:10 hours—which represented a substantial increase over the 2:35 hours of outage reported in February and 2:45 hours in January.

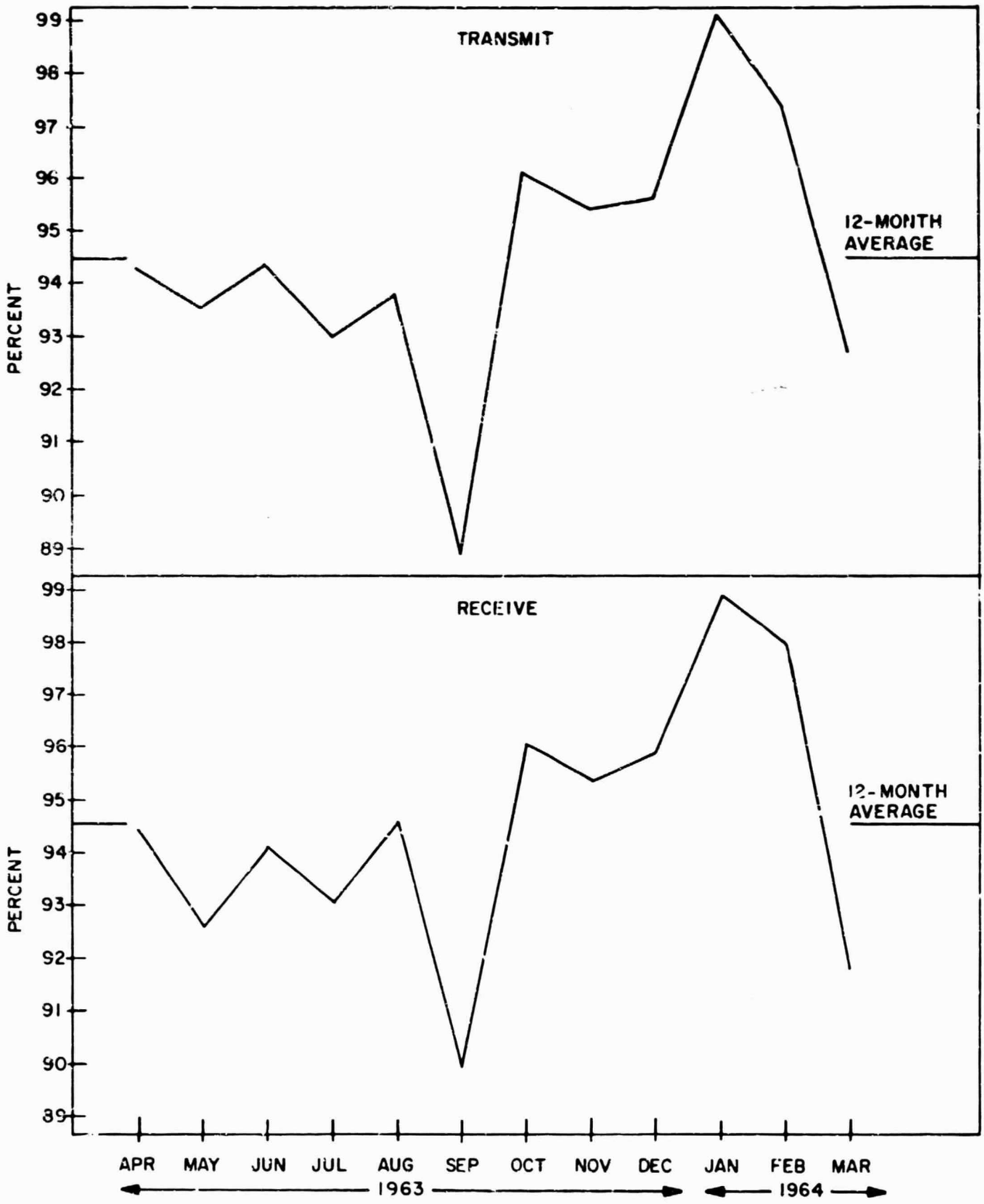


Figure 16. Circuit Reliability of RA-35

Table 12

SCAMA Telephone Network Stations/Circuits

Circuit Number	Location
GP-1078	Guaymas, Mexico
GP-1143	Langley, Va.
GP-1145	Wallops Island, Va. #1
GP-1266	Eglin AFB, Fla.
GP-1267	Corpus Christi, Texas
GP-1268	White Sands, N. M.
GP-1269	Pt. Arguello, Calif.
GP-1274	Bermuda #1
GP-1431	Bermuda #2
GP-2288	Cape Kennedy-MCC #1
GP-2289	Cape Kennedy-MCC #2
GP-2290	Cape Kennedy-MCC #3
GP-2291	Cape Kennedy-MCC #4
GP-2292	Cape Kennedy-MCC #5
GP-2293	Cape Kennedy-MCC #6
GP-2296	Canton Island, Kauai
GP-2456	New York City (RCA ord. wire)
GP-2449	Owings Mills, Md. (Bendix)
GP-2465	Cape Kennedy-MCC #7
GFA-18102	Wallops Island, Va. #2
GFA-18103	Wallops Island, Va. #3
GFA-18105	Gilmore Creek, Alaska #1
GFA-18106	Gilmore Creek, Alaska #2
GFA-18110	Point Mugu, Calif. (PMR)
GFA-18110	San Nicolas Island, Calif.
GFA-18111	Point Mugu, Calif. (PMR)
GFA-18111	San Nicolas Island, Calif.
GFA-18112	U.S. Weather Bur. #1, Suitland, Md.
GFA-18113	U.S. Weather Bur. #2, Suitland, Md.
GFA-18114	U.S. Weather Bur. #3, Suitland, Md.
GFA-18115	Gilmore Creek, Alaska

Circuit Number	Location
GFA-18116	Heightstown, N. J.
GFA-18117	Houston, Tex.-MSC #1
GFA-18118	Huntsville, Ala.-MSFC
GFA-18119	Univ. Bldg., Adelphia, Md.
GP-52059	Cape Kennedy-MCC #8
GP-52060	Grand Canary Island, Kano, Majunga (Malagasy)
GP-52120	Houston, Tex.-MSC #2
GP-52129	Wallops Island, Va. #4
GP-52338	Ft. Monmouth, N. J.
GP-52357	Nutley, N. J. & Andover, Maine
GP-52375-1	Gilmore Creek, Alaska
GP-52375-2	
GP-52375-3	
GP-52375-4	
GP-52392	Johannesburg, S. A.
GP-52417	Fucino, Italy; Goonhilly, England; Pluemuer-Bodou, France; Raisting Point, Germany
GP-52474	Univ. Bldg., Adelphi, Md. #1
GP-52475	Univ. Bldg., Adelphi, Md. #2
GP-52476	Univ. Bldg., Adelphi, Md. #3
GDA-52481	Fort Myers, Fla.
GP-52483	Pasadena, Calif.-JPL #1
GP-52485	Cherry Hill, N. J.
GDA-52497	Pasadena, Calif.-JPL #2
GDA-52498	Nutley, N. J.
GD-52500	Johannesburg, S. A.
GDA-52501	Rosman, N. C.
GP-52504	Lakehurst & Fort Dix, N. J.
GP-52518	Carnarvon, Australia; Muchea, Australia; Woomera, Australia
GP-52521	Barstow, Calif.

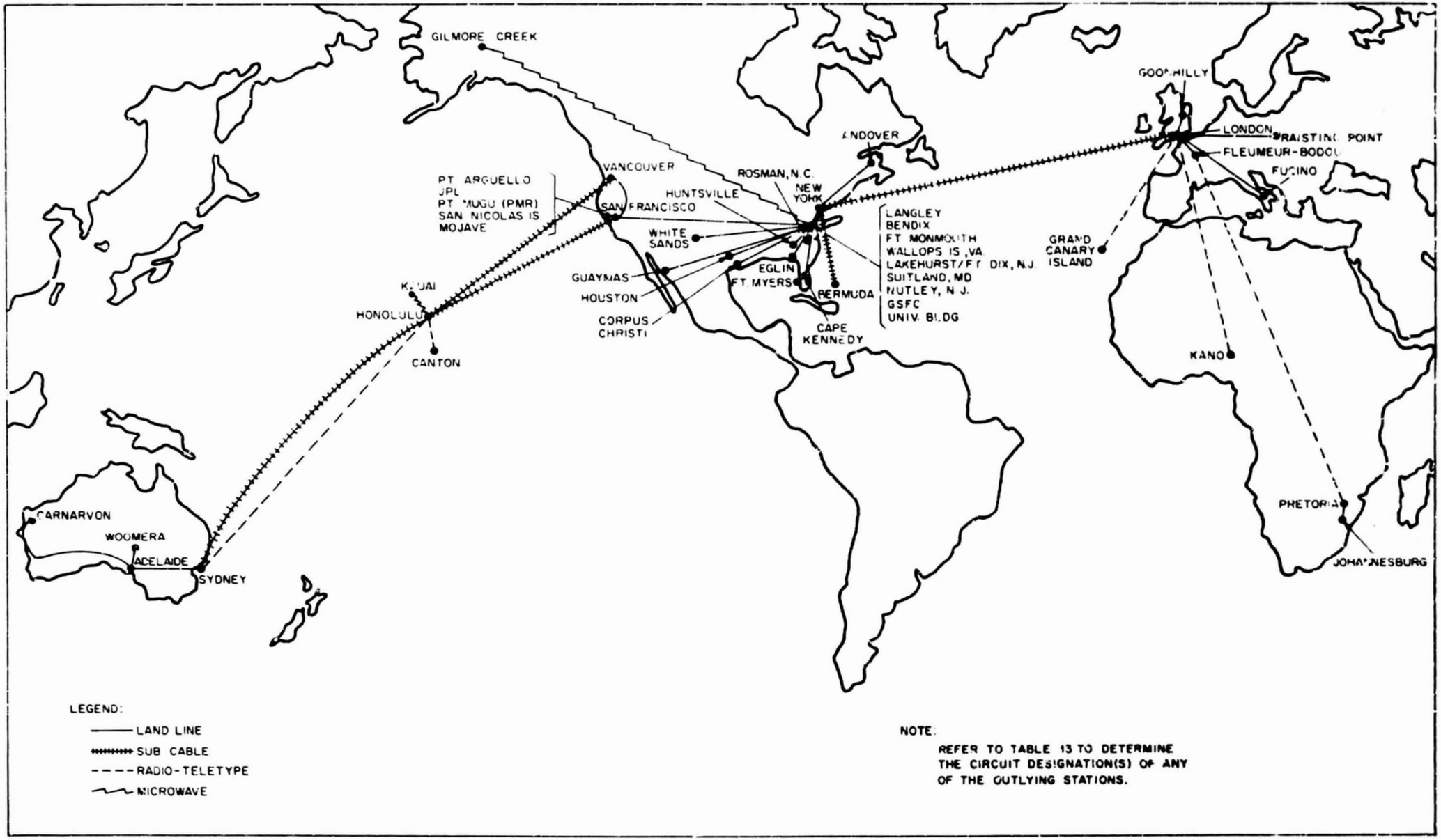


Figure 17. Map of SCAMA Telephone Network Stations/Circuits

SCAMA TELEPHONE NETWORK PERFORMANCE AND ANALYSIS OF RELIABILITY

General Discussion

The SCAMA (Switching, Conferencing, and Monitoring Arrangement) Telephone Network of the NASCOM Network consists of the stations and/or circuits listed in Table 12. The location of these stations/circuits, together with their alpha-numeric code number, is also listed in Table 12. The geographic layout of all the stations/circuits comprising the SCAMA Network is indicated in the accompanying map, Figure 17.

Analyses of the performance of the overall SCAMA Network and/or of each of the SCAMA stations/circuits are presented in Figure 18 and in Tables 13, 14, 15, and 16.

A detailed breakdown of all interruptions, both by type and number, on all segments of the SCAMA Network in March is presented in Table 13. Total outage time accrued during the month, together with total scheduled operating time, and the resulting reliability index for each SCAMA station/circuit analyzed, is presented in Table 14.

A comparative analysis for the 6-month period from October 1963 through March 1964 of outage time by trouble categories for the entire SCAMA Network is presented in Table 15. Included is a separate breakdown for transmit and receive paths.

The total outage time for the entire SCAMA Network, the total number of interruptions, and the average duration of these interruptions over the 12-month period from April 1963 through March 1964 are presented in Table 16. Overall SCAMA Network reliability for this same 12-month period is shown graphically in Figure 18.

Overall Performance

The average combined reliability of the 70 SCAMA stations/circuits included in the analysis covered by this report was 99.0 percent in March, compared with 99.1 percent in February—a decrease of 0.1 percentage points.

For the month of March, 32 SCAMA circuits experienced 100 percent reliability, 58 had better than 99 percent, and 68 of the 70 now in use had better than 95 percent. Total outage time increased from 349 hours in February to 458 hours in March. Totaling 109 hours, this increase affected the overall reliability only 0.1 percent, the reason being that scheduled operating time increased proportionately (to 31,621 hours, a gain of almost 2000 hours).

Specific Problems

Poor propagation, frequency changing, and interference again "clobbered" Johannesburg (South Africa) circuits GP-52392 and GDA-52500. Out of a total of 159:29 hours of outage in the month, GP-52392 was out 149:22 hours for these reasons. GDA-52500, which had a total of 175:17 hours of outage time in the month, was out 141:10 hours for the same reasons. It appears that during that part of the solar cycle prevailing during the period, these two circuits will "limp" along at about 80 percent reliability. Accordingly the Communications Division is investigating the possibilities of using alternate modes and routes for these two circuits in an effort to achieve higher monthly reliability figures. Under consideration are routes via South America and Ascension Island using cable and radio. It appears that a combination of routes will provide the most dependable communications inasmuch as it will permit selection of the best route for a particular time of day.

Circuit GP-1267 (Corpus Christi, Texas) had just two outages in March, totaling 7:04 hours. Of this amount, 5:47 hours were due to a severed cable and to maintenance at the frame at the site. The remaining time (1:17 hours) was charged to the no-trouble-found category. Scheduled operating time being only 198 hours, the reliability index for GP-1267 was 96.4 percent.

Circuit GP-2289 (MCC-1, Cape Kennedy, Florida) was out 4: 16 hours on March 23 because of faulty repeaters in the Washington (D. C.) office. This was the only outage on this circuit. Scheduled operating time being only 319 hours, a reliability index of 98. 7 percent was reached by the circuit.

Circuit GP-2296 (Canton Island and Kauai, Hawaii) has a reliability index, based on both segments of the circuit, of 98. 8 percent for the month. This represented a decline from the February level, which was 99. 5 percent. An increase in outage time due to microwave trouble was primarily responsible.

Circuit GFA-18116 (Heightstown, New Jersey) logged 3: 53 hours of outage due to an open ring-lead at Heightstown. Though charged to a wiring defect, this failure (a defective plug or jack) raised the question of whether a bad jack or plug constituted a wiring defect or an equipment defect.

Circuit GP-52060 (Canton Island; Kano, Nigeria; Majunga, Malagasy) on the Canton Island portion suffered several outages during the month due primarily to both line troubles and line maintenance (or scheduled and unscheduled maintenance). The Kano-Majunga extension of the circuit was out because of propagation difficulties for 1: 10 hours on March 16. Actual total outage time accrued on the circuit was not great, however. Scheduled operating time was only about 170 hours and the indexes were 95. 4, 98. 7, and 98. 7 percent for Canton Island, Kano, and Majunga, respectively.

Circuit GP-52417 (Fucino, Italy; Pleurmuer-Bodou, France; and Raisting Point, Germany) on the Pleurmuer-Bodou leg had a 2: 23-hours outage on March 4.

At 0715Z, the circuit went dead, but later came clear while being checked. On analysis, this kind of incident raises the question of whether or not perhaps a plug had been inadvertently pulled somewhere along the line and then later reinserted without the incident being reported.

Circuit GDA-52521 (Barstow, California) accrued a total of 28: 45 hours of outage time, most of which (20: 40 hours) was due to wind damage on the carrier between Goldstone and Barstow. An undetermined cause accounted for 4: 27 more hours of outage time. In this case the trouble ticket implied the possibility of operator inattention; however, it should be noted, this reason remained only a suspicion.

One new circuit was added to the SCAMA system on 10 March; however, it will not be analyzed until "shakedown" is completed and the circuit is fully operational.

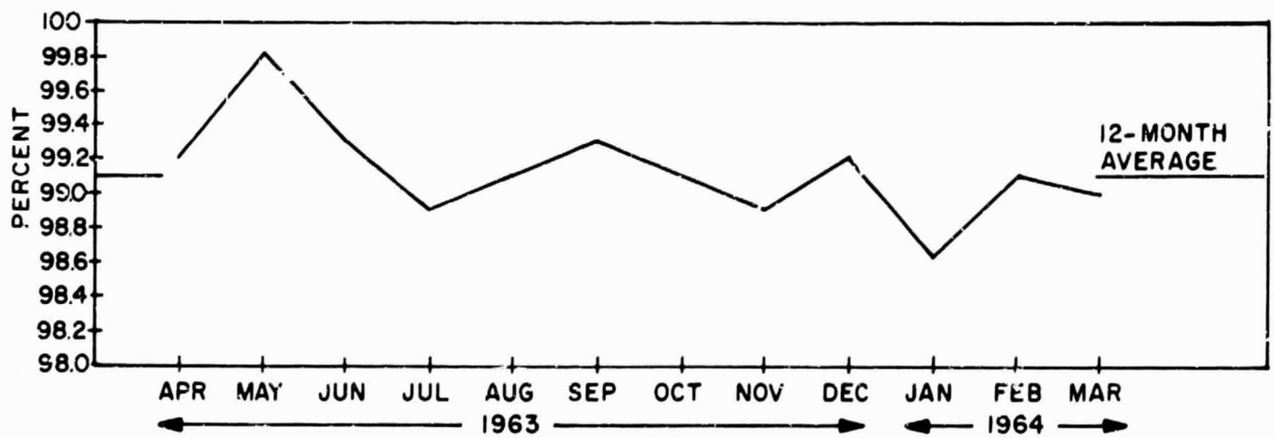


Figure 18. Reliability—SCAMA Telephone Network
April 1963 through March 1964

Table 13

Interruptions, by Trouble Categories, on Scama Stations/Circuits

CIRCUIT NUMBER	LOCATION	TROUBLE CATEGORIES* (Number of Interruptions)											
		A	B	C	D	E	F	G	I	K	M	P	TOTAL
GP-1078	Guaymas, Mexico	2	1	2	-	1	-	-	-	-	-	-	6
1143	Langley, Va.	-	-	-	-	-	-	-	-	-	-	-	0
1145	Wallops Island, Va. #1	-	-	-	-	-	-	-	-	-	-	-	0
1266	Eglin, Fla.	-	-	-	-	-	-	-	-	-	-	-	0
1267	Corpus Christi, Texas	1	1	-	-		-	-	-	-	-	-	2
1268	White Sands, N. M.	-	-	-	-	-	-	-	-	-	-	-	0
1269	Pt. Arguello, Calif.	1	-	-	-	-	-	-	-	-	-	-	1
1274	Bermuda #1	-	-	-	-	-	-	-	-	-	-	-	0
1431	Bermuda #2	-	-	-	-	-	-	-	-	-	-	-	0
2288	MCC, Cape Kennedy, Fla. #1	-	-	-	-	-	-	-	-	-	-	-	0
2289	MCC, Cape Kennedy, Fla. #2	-	-	-	-	1	-	-	-	-	-	-	1
2290	MCC, Cape Kennedy, Fla. #3	-	-	-	-	-	-	-	-	-	-	-	0
2291	MCC, Cape Kennedy, Fla. #4	-	-	-	-	-	-	-	-	-	-	-	0
2292	MCC, Cape Kennedy, Fla. #5	-	-	-	-	-	-	-	-	-	-	-	0
2293	MCC, Cape Kennedy, Fla. #6	-	-	-	-	-	-	-	-	-	-	-	0
2296	Canton Island	1	2	-	-	-	-	-	-	-	-	-	3
2296	Kauai, Hawaii	1	1	-	-	1	-	-	-	-	-	-	3
2406	New York, N. Y. (RCA Order Wire)	-	-	-	-	-	-	-	-	-	-	-	0
2449	Owings Mills, Md. (Bendix)	-	-	-	-	-	-	-	-	-	-	-	0
2465	MCC, Cape Kennedy, Fla. #7	-	-	-	-	1	-	-	-	-	-	-	1
GFA-18102	Wallops Island, Va. #2	-	1	-	-	-	-	-	-	-	-	-	1
18103	Wallops Island, Va. #3	3	-	-	-	1	-	-	-	-	-	-	4
18105	Gilmore Creek, Alaska #1	-	2	-	-	1	-	-	-	-	-	-	3
18106	Gilmore Creek, Alaska #2	1	-	-	-	-	-	-	-	-	-	-	1
18110	PMR, Point Mugu, Calif.	-	-	-	-	1	-	-	-	-	-	-	1
18110	San Nicolas Island, Calif.	-	-	-	-	1	-	-	-	-	-	-	1
18111	PMR, Point Mugu, Calif.	-	-	-	-	1	-	-	-	-	-	-	1
18111	San Nicolas Island, Calif.	-	-	-	-	1	-	-	-	-	-	-	1
18112	U.S. Weather Bureau, Suitland, Md. #1	-	-	-	-	-	-	-	-	-	-	-	0
18113	U.S. Weather Bureau, Suitland, Md. #2	-	-	-	-	-	-	-	-	-	-	-	0
18114	U.S. Weather Bureau, Suitland, Md. #3	-	-	-	-	-	-	-	-	-	-	-	0
18115	Gilmore Creek, Alaska #3	-	-	-	-	-	-	-	-	-	-	-	0
18116	Heightstown, N. J.	-	-	-	-	-	1	-	-	-	-	-	1
18117	MSC, Houston, Texas	-	-	-	-	-	-	-	-	-	-	-	0
18118	MSFC, Huntsville, Ala.	1	-	-	1	-	-	-	-	-	-	1	3
18119	Univ. Bldg., Adelphia, Md. #4	-	-	-	-	-	-	-	-	-	-	-	0
GP-52059	MCC, Cape Kennedy, Fla. #8	-	-	-	-	-	-	-	-	-	-	-	0
52060	Grand Canary Island	1	3	-	-	1	-	-	-	-	1	-	6
52060	Kano, Nigeria	-	1	-	-	2	-	1	-	-	-	-	4
52060	Majunga, Malagasy	-	1	-	-	2	-	1	-	-	-	-	4
52120	IMCC, Houston, Texas #2	2	-	-	-	-	-	-	-	-	-	-	2

Table 13 (Continued)

Interruptions, by Trouble Categories, on Scama Stations/Circuits

CIRCUIT NUMBER	LOCATION		TROUBLE CATEGORIES* (Number of Interruptions)											
			A	B	C	D	E	F	G	I	K	M	P	TOTAL
GP-52129	Wallops Island	#4	3	-	-	-	-	-	-	-	-	-	-	3
52338	Ft. Monmouth, N. J.		-	-	-	-	-	1	-	-	-	-	-	1
52357	Nutley. N. J.		1	1	-	-	-	-	-	-	-	-	-	2
52357	Andover, Maine		1	1	-	-	-	-	-	-	-	-	-	2
52375-1	Gilmore Creek, Alaska	#4	1	2	-	-	1	-	-	-	-	-	1	5
52375-2	Gilmore Creek, Alaska	#5	1	2	-	-	1	-	-	-	-	-	1	5
52375-3	Gilmore Creek, Alaska	#6	1	2	1	1	2	1	-	-	-	-	1	9
52375-4	Gilmore Creek, Alaska	#7	-	2	-	-	-	1	-	-	-	-	1	4
52392	Johannesburg, S. A.		4	2	1	2	3	-	55	6	32	-	2	107
52417	Fucino, Italy		-	-	-	-	-	-	-	-	-	-	-	0
52417	Goonhilly, England		-	-	-	-	-	-	-	-	-	-	-	0
52417	Pluemuer-Bodou, France		1	-	-	-	-	-	-	-	-	-	-	1
52417	Raisting Point, Germany		-	1	-	-	-	-	-	-	-	-	-	1
52474	Univ. Bldg., Adelphia, Md.	#1	-	-	-	-	-	-	-	-	-	-	-	0
52475	Univ. Bldg., Adelphia, Md.	#2	-	-	-	-	-	-	-	-	-	-	-	0
52476	Univ. Bldg., Adelphia, Md.	#3	-	-	-	-	-	-	-	-	-	-	-	0
GDA-52481	Fort Myers, Fla.		-	-	-	-	-	-	-	-	-	-	-	0
GP-52483	JPL, Pasadena, Calif.		-	-	1	-	-	-	-	-	-	-	-	1
52485	Cherryhill, N. J.		-	-	-	-	-	-	-	-	-	-	-	0
GDA-52497	JPL, Pasadena, Calif.		-	-	-	-	-	-	-	-	-	-	-	0
52498	Nutley, N. J.		-	-	-	-	-	-	-	-	-	-	-	0
52500	Johannesburg, S. A.		6	4	2	3	2	-	51	6	39	-	2	115
52501	Rosman, N. C.		-	1	-	-	1	-	-	-	-	-	-	2
GP-52504	Lakehurst, N. J.		-	-	-	-	-	-	-	-	-	-	-	0
52504	Fort Dix, N. J.		-	-	-	-	-	-	-	-	-	-	-	0
52518	Carnarvon, Australia		-	1	-	-	-	-	-	-	-	-	-	1
52518	Muchea, Australia		1	1	-	-	-	-	-	-	-	-	-	2
52518	Woomera, Australia		-	-	-	-	-	-	-	-	-	-	-	**0
52521	Barstow, Calif.		5	5	-	-	-	-	-	-	-	-	-	10
Totals			38	39	7	7	25	4	108	12	71	1	9	321

*Legend:

A - No trouble found
B - Line-cable-microwave
C - Operator error
D - Equipment adjustment
E - Equipment failure
F - Wiring defect
G - Poor propagation
I - Interference
K - Frequency change
M - Maintenance
P - Power failure

** AWOM—GP-52518 is being operated on a part time basis with no regular schedule.

Table 14

SCAMA Stations Circuits Outage Time by Trouble Categories, Scheduled Operating Hours, and Reliability

CIRCUIT	STATION	TROUBLE CATEGORIES* (Hours and Minutes)											TOTAL LOST TIME (Hours and Minutes)	SCHED OPERATING TIME (Hours)	RELIABILITY (Percent)
		A	B	C	D	E	F	G	I	K	M	P			
GP-1078	GGYM	:58	:04	:27	-	.39	-	-	-	-	-	-	2:08	744	99.7
1143	Langley	-	-	-	-	-	-	-	-	-	-	-	:00	176	100.0
1145	GWLP	-	-	-	-	-	-	-	-	-	-	-	:00	744	100.0
1266	GEGL	-	-	-	-	-	-	-	-	-	-	-	:00	272	100.0
1267	GTEX	1:17	5:47	-	-	-	-	-	-	-	-	-	7:04	198	96.4
1268	GWHS	-	-	-	-	-	-	-	-	-	-	-	:00	181	100.0
1269	GCAL	-	1:20	-	-	-	-	-	-	-	-	-	1:20	744	99.8
1274	GBDA	-	-	-	-	-	-	-	-	-	-	-	:00	195	100.0
1431	GBDA	-	-	-	-	-	-	-	-	-	-	-	:00	195	100.0
2288	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0
2289	GMCC	-	-	-	-	4:16	-	-	-	-	-	-	4:16	319	98.7
2290	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0
2291	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0
2292	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0
2293	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0
2296	PCTN	:20	1:12	-	-	-	-	-	-	-	-	-	1:32	66	97.7
2296	PHAW	:20	1:01	-	-	2:28	-	-	-	-	-	-	3:49	326	98.8
2406	RCANY O W	-	-	-	-	-	-	-	-	-	-	-	:00	744	100.0
2449	GBEN	-	-	-	-	-	-	-	-	-	-	-	:00	176	100.0
2465	GMCC	-	-	-	-	2:03	-	-	-	-	-	-	2:03	744	99.7
GFA-18102	GWLP	-	3:41	-	-	-	-	-	-	-	-	-	3:41	744	99.5
18103	GWLP	6:05	-	-	-	:16	-	-	-	-	-	-	6:21	744	99.1
18105	GULA	-	3:11	-	-	:30	-	-	-	-	-	-	3:41	744	99.5
18106	GULA	2:26	-	-	-	-	-	-	-	-	-	-	2:26	744	99.7
18110	GPMR	-	-	-	-	:47	-	-	-	-	-	-	:47	744	99.9
18110	GOLA	-	-	-	-	:47	-	-	-	-	-	-	:47	744	99.9
18111	GPMR	-	-	-	-	:40	-	-	-	-	-	-	:40	744	99.9
18111	GOLA	-	-	-	-	:40	-	-	-	-	-	-	:40	744	99.9
18112	GSWB	-	-	-	-	-	-	-	-	-	-	-	:00	744	100.0
18113	GSWB	-	-	-	-	-	-	-	-	-	-	-	:00	744	100.0
18114	GSWB	-	-	-	-	-	-	-	-	-	-	-	:00	744	100.0
18115	GULA	-	-	-	-	-	-	-	-	-	-	-	:00	744	100.0
18116	GHNJ	-	-	-	-	-	3:53	-	-	-	-	-	3:53	176	97.8
18117	HMSC	-	-	-	-	-	-	-	-	-	-	-	:00	176	100.0
18118	GALA	:30	-	-	:33	-	-	-	-	-	-	:26	1:29	176	99.2
18119	GUNV	-	-	-	-	-	-	-	-	-	-	-	:00	264	100.0
GP-52059	GMCC	-	-	-	-	-	-	-	-	-	-	-	:00	319	100.0
52060	LCYI	:15	5:32	-	-	:09	-	-	-	-	1:46	-	7:42	168	95.4

Table 14 (Continued)

SCAMA Stations/Circuits Outage Time by Trouble Categories, Scheduled Operating Hours, and Reliability

CIRCUIT	STATION	TROUBLE CATEGORIES* (Hours and Minutes)											TOTAL LOST TIME (Hours and Minutes)	SCHED OPER-ATING TIME (Hours)	RELIABILITY (Percent)
		A	B	C	D	E	F	G	I	K	M	P			
GP-52060	LKNO	-	:29	-	-	:31	-	1:10	-	-	-	-	2:10	170	98.7
52060	LMAJ	-	:29	-	-	:31	-	1:10	-	-	-	-	2:10	170	98.7
52120	HMSC	1:14	-	-	-	-	-	-	-	-	-	-	1:14	176	99.3
52129	GWLP	:16	-	-	-	-	-	-	-	-	-	-	:16	744	99.9
52338	GTOC	-	-	-	-	-	:28	-	-	-	-	-	:28	176	99.7
52357	GCON	1:09	:26	-	-	-	-	-	-	-	-	-	1:35	372	99.6
52357	GMAN	1:09	:26	-	-	-	-	-	-	-	-	-	1:35	372	99.6
52375-1	Gil Creek	:28	1:54	-	-	1:53	-	-	-	-	-	:13	4:28	744	99.4
52375-2	Gil Creek	1:20	1:54	-	-	1:53	-	-	-	-	-	:13	5:20	744	99.3
52375-3	Gil Creek	:53	1:54	:36	:14	1:56	:20	-	-	-	-	:13	6:06	744	99.2
52375-4	Gil Creek	-	1:54	-	-	-	1:53	-	-	-	-	:13	4:00	744	99.5
52392	GBUR	1:14	:45	:17	:41	2:00	-	122:06	6:19	21:07	-	5:00	159:29	744	78.6
52417	LTEL	-	-	-	-	-	-	-	-	-	-	-	:00	240	100.0
52417	LHIL	-	-	-	-	-	-	-	-	-	-	-	:00	391	100.0
52417	LBOD	2:23	-	-	-	-	-	-	-	-	-	-	2:23	200	98.8
52417	LGEA	-	1:31	-	-	-	-	-	-	-	-	-	1:31	205	99.3
52474	GUNV	-	-	-	-	-	-	-	-	-	-	-	:00	264	100.0
52475	GUNV	-	-	-	-	-	-	-	-	-	-	-	:00	264	100.0
52476	GUNV	-	-	-	-	-	-	-	-	-	-	-	:00	264	100.0
GDA-52481	GYRS	-	-	-	-	-	-	-	-	-	-	-	:00	744	100.0
GP-52483	JJPL	-	-	1:46	-	-	-	-	-	-	-	-	1:46	744	99.3
52485	Cherry Hill	-	-	-	-	-	-	-	-	-	-	-	:00	176	100.0
GDA-52497	JJPL	-	-	-	-	-	-	-	-	-	-	-	:00	744	100.0
52498	GCON	-	-	-	-	-	-	-	-	-	-	-	:00	372	100.0
52500	GBUR	4:00	10:30	:32	1:28	11:07	-	106:44	7:12	27:14	-	5:50	174:17	744	76.5
52501	GROS	-	3:22	-	-	1:00	-	-	-	-	-	-	4:22	744	99.4
GP-52504	GTLH	-	-	-	-	-	-	-	-	-	-	-	:00	372	100.0
52504	GDIX	-	-	-	-	-	-	-	-	-	-	-	:00	372	100.0
52518	ACRO	-	:35	-	-	-	-	-	-	-	-	-	:35	231	99.7
52518	AMUC	:20	:35	-	-	-	-	-	-	-	-	-	:55	140	99.3
52518	AWOM	-	-	-	-	-	-	-	-	-	-	-	:00	140	100.0
52521	JMOJ	4:27	24:18	-	-	-	-	-	-	-	-	-	28:45	744	96.1
	TOTALS	31:04	72:50	3:38	2:56	34:06	6:34	2[illegible]1:10	13:31	48:21	1:46	12:08	458:04	31,621	99.0

*Legend

A - No trouble found
B - Line-cable-microwave
C - Operator error
D - Equipment adjustment
E - Equipment failure
F - Wiring defect
G - Poor propagation
I - Interference
K - Frequency change
M - Maintenance
P - Power failure

Table 15

Outage Time and Reliability for the SCAMA Telephone Network
(October 1963 through March 1964)

TROUBLE CATEGORIES		(Hours and Minutes)					
		OCT 1963	NOV 1963	DEC 1963	JAN 1964	FEB 1964	MAR 1964
A	No trouble found	30:26	39:25	29:50	28:43	29:59	31:04
B	Line-cable-microwave	42:36	71:31	41:59	130:16	18:40	72:50
C	Operator error	13:37	2:49	1:13	5:15	3:05	3:38
D	Equipment adjustment	28:42	1:37	1:38	2:07	3:57	2:56
E	Equipment failure	8:27	18:36	12:01	16:31	5:02	34:06
F	Wire defect	8:51	8:17	11:43	7:22	3:56	6:34
G	Poor propagation	66:39	29:44	87:22	249:18	194:24	23[illegible]:10
I	Interference	2:40	5:52	1:33	13:11	20:15	13:31
K	Frequency change	29:26	27:47	31:08	52:56	57:08	48:21
M	Maintenance	-	-	-	9:05	10:04	1:46
P	Power failure	1:17	9:23	:57	4:30	2:54	12:08
	TOTAL OUTAGE	232:41	245:01	219:24	519:14	349:25	458:04
	SCHED OPER TIME	26,455	24,114	25,841	29,307	29,636	31,621
	RELIABILITY (Percent)	99.1	98.9	99.2	98.6	99.1	99.0

Table 16

SCAMA Telephone Network Outage Time, Number of Interruptions, and Average Duration of Interruptions (April 1963 through March 1964)

MONTH	OUTAGE TIME (Hours and Minutes)	INTERRUPTIONS	AVERAGE DURATION OF OUTAGE PER INTERRUPTION (Minutes)
Mar (1964)	458:04	321	85
Feb (1964)	349:25	398	54
Jan (1964)	519:14	407	77
Dec (1963)	219:24	167	79
Nov (1963)	245:01	176	84
Oct (1963)	232:41	174	80
Sep (1963)	24:30	36	40
Aug (1963)	82:41	93	53
Jul (1963)	72:42	68	70
Jun (1963)	21:30	35	37
May (1963)	17:16	46	23
Apr (1963)	157:30	189	50

HIGH-SPEED DATA CIRCUITS

The full-duplex high-speed data circuits emanating at GSFC are as follows:

GSFC-Cape Kennedy	GSFC-Bermuda
GD-1262	GDA-52027
GD-1263	GDA-52028
GD-1264	
GD-1265	

Again, as was the case in February, high-speed data traffic was very light in March. New equipment was installed from time to time; however, installation did not interrupt operating schedules. Several interruptions did occur during scheduled operating hours, but they were of very short duration and comparatively insignificant insofar as overall circuit performance was concerned.